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Scope for Co-operative Action

We have on a number of occasions dealt with the desirability of remelting cast-iron borings in the cupola. To-day, owing to the general shortage of raw materials, this desirability has been transformed into a matter of extreme urgency. In the past, some firms found it economical to pack turnings in canisters or even wooden boxes, before charging into the cupola, but present-day costs rule out such practices. Some experiments, personally carried out many years ago, having for their object the production of refined iron by the melting of turnings in the electric furnace, were a failure, owing to the extreme length of the melting-down period and a consequent high current consumption. This was due, we thought, to the formation of refractory graphite walls surrounding the "tunnels" made by the descending electrodes. Modern furnaces, having a much higher power input, might possibly overcome such difficulties. If modern high-powered electric furnaces are capable of melting swarf, then the original object of our earlier experiments, that is, the production of refined pig-iron, could be achieved without too much difficulty.

A process, which has been a technical success, is the briquetting of swarf. Economically it has often been condemned on the grounds that but few firms have sufficient production of borings to keep a costly press at work for periods sufficiently prolonged to be considered practical. Spasmodic operation has killed much earlier enthusiasm for the process. To remedy such a situation there are two obvious solutions. One is by co-operative action amongst firms located in areas where there is a heavy production of borings, and the second is the installation of plant by the larger scrap merchants. We have reason to believe that such actions would have the help and the co-operation of the Ministry of Supply, as it is just as concerned as the foundry industry in the conservation of so much valuable metal now very largely going to waste. Only last week we commented upon the position in South Africa, where the briquetted swarf has the density of 75 per cent. of true steel or cast iron, and a limit of 15 per cent. is placed on the use of this material as a constituent of the charge. Tailings bonded with cement have been the subject of experiment in this country, but apparently unlike South Africa, no promising results have been reported. Mixing with sand before charging direct into the cupola for pig making has also been tried with varying success.

We have qualified an earlier statement by the inclusion of the words "very largely," for it has been reported that some foundries manage to recover some of this material, by charging each evening a limited quantity into the cupola after the day's blow. The residual heat is said to be sufficient to melt a small charge which can be cast into a pig bed and later remelted. If any of our readers have any experience of the successful reclamation of cast-iron turnings and the like, we shall be pleased to give publicity to their results. The conservation of all metallic raw materials is a matter of national importance and the specific problem of converting swarf back into useful metal should be capable of solution by a co-operative attack using modern technology.

Conference on Recruitment, Training, and Education

As previously announced, the Council of Ironfoundry Associations is arranging a short conference on recruitment, training and education, to be held at Ashorne Hill near Leamington Spa from mid-day on Wednesday, March 12, to midday on Friday, March 14. Presiding at the conference will be Mr. S. H. Russell, chairman of the C.F.A.'s Development Panel and leader of the Grey Ironfoundry Productivity Team which went to America in 1950.

Programme

A general outline of the programme is given below (though this may be subject to revision). All firms belonging to Associations connected with the C.F.A. have been invited to send representatives to the conference, and if the limited accommodation permits, applications from non-member firms will be accepted. Forms of application to participate can be obtained from the secretary of the C.F.A., 14, Pall Mall, London, S.W.1. Applications should be sent in not later than Monday, March 3.

Wednesday, March 12

2 p.m.—Opening Address by the chairman.

2.35 p.m.—Use of Films and other Visual Aids (accompanied by an exhibition of instructional material); Survey of the Scope of Training in Industry; Recruitment and Vocational Education and including Reports from the main ironfounding areas.

7.30 p.m.—Dinner.

8.15 p.m.—Programme of industrial training films.

Thursday, March 13

9 a.m.—Training for Management; Proposals for a National Scheme of Foundry Training.

12.30 p.m.—Luncheon.

2 p.m.—University Graduates in Industry; Company Training Schemes, and the work of the National Foundry Craft Training Centre.

4.30 p.m.—Tea.

5 p.m.—Training in Foremanship.

7 p.m.—Dinner.

8 p.m.—Discussion Groups. (Among the themes for discussion will be the following:—(*a*) Forming closer links between education and industry; (*b*) training the semi-skilled adult worker; (*c*) following-up training within industry; (*d*) higher technological training, and (*e*) training in safety-first and physical skills.)

Friday, March 14

9 a.m.—Foreign Schemes of Foundry Training: a review of American, French and German practice; Reports from the leaders of the discussion groups held the previous evening.

11.30 a.m.—Close of the conference, dispersal after luncheon.

Details of the principal speakers will be announced shortly.

Trading in Lead.—The Chancellor of the Duchy of Lancaster last week received a deputation from the committee of the London Metal Exchange to discuss the possibility of a return to private trading in lead on the London Metal Exchange. The Chancellor promised to give careful consideration to the views expressed.

Sir William J. Larke Medal

The Institute of Welding has conferred the Sir William J. Larke Medal, their highest award, upon Mr. W. S. Atkins, B.Sc., M.I.C.E., for his paper "Continuous Welded Structures—Abbey Works, Port Talbot." Papers highly commended by the examiners were those of Mr. J. Latimer on "Automatic Welding" and Mr. A. R. Moss on "The Welding of Cast Iron."

New British Chemical Standards

The Bureau of Analysed Samples, Limited, announces that the following new standard samples are now available:—

B.C.S. No. 247, *White Cast Iron.*—T.C 3.07, and S 0.186 per cent. This sample has been specially prepared for the determination of total carbon and sulphur by combustion. In the absence of graphite, 80-mesh crushed material presents no complications as to the distribution of graphite, and is therefore specially recommended for the daily routine check estimations put through a combustion apparatus prior to carrying out determinations for total carbon or sulphur.

B.C.S. No. 246 *Nb-Mo* 18/8 *Stainless Steel.*—C 0.062, Nb 0.82, and Mo 2.89 per cent. This sample has been specially prepared for checking the determination of niobium in stainless steels, also for giving accurate determinations of carbon in low-carbon stainless steels. It is also useful for checking the determination of molybdenum in high-molybdenum stainless steels.

General.—As usual, each standard sample is available in bottles of 25, 50, 100, and 500 gm., and can be obtained through the usual laboratory furnishers or direct from the Bureau of Analysed Samples, Limited, 234, Marton Road, Middlesbrough. Each bottle is provided with a certificate giving the results of each contributing analyst and an outline of the method used for each element.

Electron Microscope

The use of the electron microscope was described in a survey of recent work carried out by Dr. V. Cosslett, of the Cavendish Laboratory, Cambridge, to the Scottish branch of the Institute of Physics at Glasgow last week. He discussed the results of investigations concerning the metallurgical problem of metal "slip" where it has been found that in the case of aluminium the nature of the "slip" is affected considerably by surface treatment such as mechanical polishing. In this connection he described two new forms of electron microscope which have been constructed in Cambridge and which will allow a specimen to be observed while it is subjected to external treatment such as heating.

These new microscopes are known as the "reflecting" type and the "back-scattering" type. In the former the electron beam falls on the object at an angle of grazing incidence of about four degrees and the reflected beam is resolved and magnified in the usual way; in the second type the beam scans the object and the scattered electrons are collected in an electron multiplier, the output of which is shown on a television type of cathode-ray tube.

1952 Minibition.—First held at Brighton in 1950, and successfully repeated at Llandudno in 1951, the Purchasing Officers Association's Minibition will this year again be an important feature of the national conference at Harrogate from October 2 to 5. The Association was formed in 1931 and at this conference its coming-of-age will be celebrated.

Films Available.—The Petroleum Film Bureau, of 29, New Bond Street, London, W.1, have sent us a 24-page booklet which lists the films they are prepared to loan to organizations and educational bodies. Of all the many dozens only one is of direct interest to the foundry industry, and that is No. 16 of the Cinemagazines series, entitled "Lost-wax Castings." The list is available to our readers on application to the librarian of the bureau at New Broad Street.

Cross-section of a Non-ferrous Jobbing Foundry*

By J. Gorman

On reviewing the modern specialized foundry of to-day with its highly mechanized plant, laboratory, and technically-controlled production and general all-round improvement in working conditions, the stigma that "the foundry is the Cinderella of the engineering industry" loses some of its significance. While the contributions of such foundries, not only in production, but in advanced foundry technology cannot be sufficiently commended, it should be borne in mind that the jobbing foundry, though lacking some of the "glamour" (if such a term can be applied to a foundry) of the modern mechanized establishment, nevertheless, still plays an important part in the industry to-day. Admittedly, it should be the aim in every branch of industry, and in none more so than in the foundry, to obtain maximum efficiency with some measure of control. However, it can readily be appreciated that, due essentially to the range and variety of work in the jobbing foundry, mechanization, except in a modified form, is neither a practical nor an economic proposition. Here, to a large extent, production is still dependent on the skilled moulder, whose comprehensive knowledge of his craft, whose versatility and whose ability to improvise are still the ruling factors in such foundries. It is with the intention of stressing these qualities, combined with the high standard of work produced that the Author proceeds to give a few typical examples of the class of work called for in a non-ferrous jobbing shop.

As any achievements of a foundry are relative to the conditions, plant at its disposal, etc., a rough description of the Author's foundry forms a useful beginning. While not a large foundry in the general sense, measured by the yardstick of the average brass foundry it can compare favourably with most.

The foundry proper, shown in Figs. 1 and 2, comprises three bays and covers an area of approximately 750 sq. yds. It is a fairly modern building with fair head-room, good lighting and ventilating conditions, concrete flooring and edgings where practicable. In the three bays all operations (green- and dry-sand moulding, coremaking, closing and casting) are compactly housed and are sufficiently mobile. Without going into elaborate detail, the equipment in the shop is such as would be consistent with a progressive and appreciative management and includes 3-ton electric overhead cranes in the dry-sand bays, sand mills, and a good supply of air for pneumatic tools. There is a jolt-squeeze moulding machine in the green-sand bay. Melting is carried out in four coke-fired tilting furnaces and six forced-draught pit furnaces, giving a total melting capacity of 28 cwt. per heat.

Flanking the main building on one side are the dressing shop, men's cloakroom and toilet and the pattern store. There is also a spacious asphalted yard with ample storage space for moulding boxes and the various raw materials required in the foundry. It may be noted that slight emphasis has been laid on the conditions underfoot, *i.e.*, asphalted yard and concrete paving and edgings in the foundry; these have been found to contribute immensely towards "good housekeeping," more than out-

* Paper read before the Scottish branch of the Institute of British Foundrymen, Mr. R. R. Taylor presiding. Later, also presented to the North Eastern section of the Scottish branch.

FIG. 1.—*General View of the Green-sand and Dry-sand Moulding Bays.*

FIG. 2.—*Dry-sand Closing and Casting Section and Core Bench.*

weighing the occasional disadvantage which may arise. Moreover, such floors greatly facilitate the recovery of scrap, an item which must be given serious thought in all non-ferrous foundries to-day. Such is a general picture of the foundry in which the following castings were made.

Pump Castings

As has been stated earlier, it is the Author's intention to try to illustrate the *variety* of work to be included in the jobbing-foundry practice—from the large pump casing to the small semi-repetition casting; from the pressure casting to the architectural casting. While it may be natural or excusable to follow a fisherman's failing and describe the large casting first, this is not done altogether from a weight point of view (23 cwt.) as this is not the heaviest casting made. The intention is rather to illustrate the method used, namely, the clay-thickness technique, and the improvization on this, on receiving an order for six of these castings.

Fig. 3 shows a 21-in. centrifugal pump casing casting. It was of the conventional pump design and had a $\frac{3}{8}$-in. wall thickness. Apart from one or two "drawbacks" on the cope and drag and the ticklish handling with a 3-ton crane of a moulding box 5 ft. square by 5 ft. overall depth, it presented no great problem as a moulding proposition. However, as the foundrymen have little liking for the clay-thickness method except under unusual circumstances, the prospect of going through the same drill for six similar castings gave rise to some preliminary consideration. The first casting *had* to be made by the normal clay-thickness technique and so, for the sake of comparison with the method ultimately adopted, a brief description of this might be advantageous. As will be seen from Fig. 4, the mould had to be a four-part job with partings on the centre line and at the stool flanges, or, alternatively, a two-part job, necessitating the removal of the stool sections of the mould as loose-pieces and drawing in the flange in separate sections. Chiefly from considerations of mould rigidity and the plant available, the second method was decided on, the loose-pieces being bolted back into position on completion of the mould. Normally, in carrying out such jobs, it has been the practice after ramming, to remove only the main body of the pattern, leaving all webs, flanges and loose-pieces in position

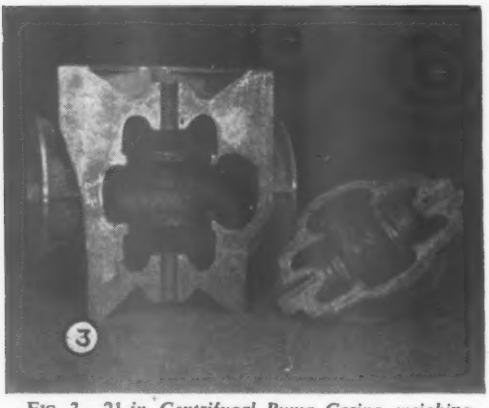


FIG. 3.—*21-in. Centrifugal Pump Casing, weighing 23 cwt., with $\frac{3}{8}$-in. Wall.*

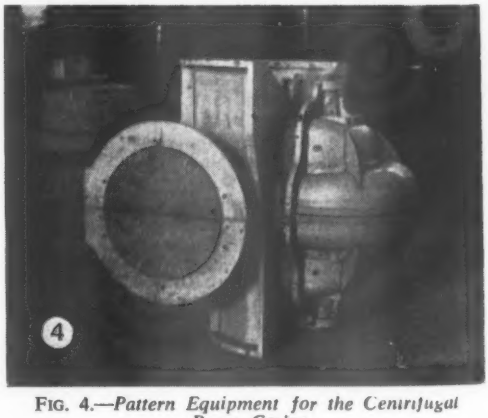


FIG. 4.—*Pattern Equipment for the Centrifugal Pump Casing.*

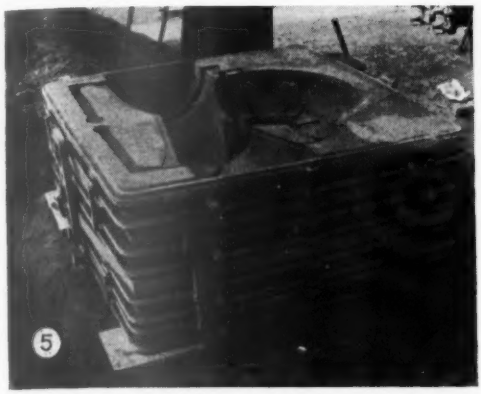


FIG. 5.—*Finished Top-side Mould for the Pump Casting.*

and proceeding at that stage to lay "thicknesses" in the mould. In this particular instance, however, the mould was finished, and Fig. 5 shows the finished top-side. This was blackwashed and dried, all flanges, webs and loose-pieces being temporarily filled in with waste and green-sand, following which the thickness pieces were laid.

Cores

The decision to change over to the completion of the top-part was dictated by the need for accurate core grids and the mould itself was the best means of obtaining these. There was also the desire to avoid any damage to the customer's pattern in the process. Two core grids were cast in each half-mould, i.e., an inlet bend and a discharge, and on removal the mould was cleaned out back to the clay thickness and work commenced on the first core, the inlet bend. Fig. 6 shows the tackle supplied for the job. In it, there are shown pieces "A" forming the bend top and bottom respectively, locating the position of the webs and determining the depth of the bearing rings "C"; piece "B" checked the depth and located the bearing rings

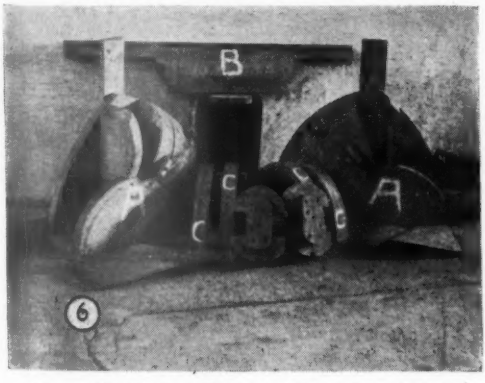


FIG. 6.—*Tackle Supplied for Making the Subsidiary Cores.*

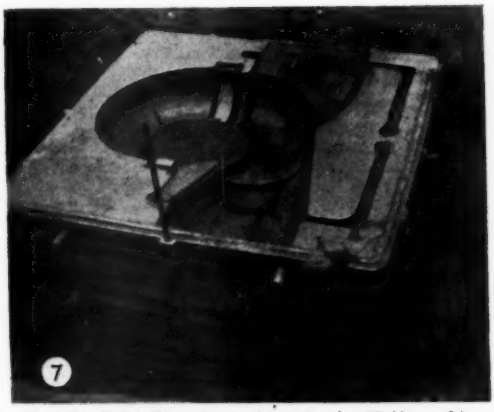


FIG. 7.—*Inlet Core in position in the Half-mould.*

relative to the face flanges. Fig. 7 shows the inlet core positioned in the mould and gives a good delineation of the desired result.

On bedding in the bearing rings in position and forming the parting as detailed, the bend section of the core was then "thicknessed" to form the wall-metal between the inlet and discharge, also completing the sweep or profile of the discharge volute. This core was subsequently rammed directly on top of the other, heavy dowels being used to give accurate location on final closing. On removal of

FIG. 8.—*Temporary "Boxes" rammed-up for the Discharge-volute Core Halves.*

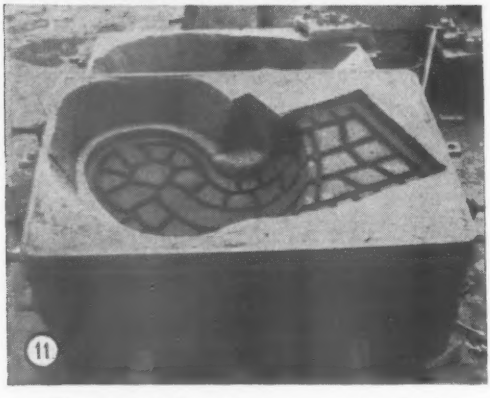
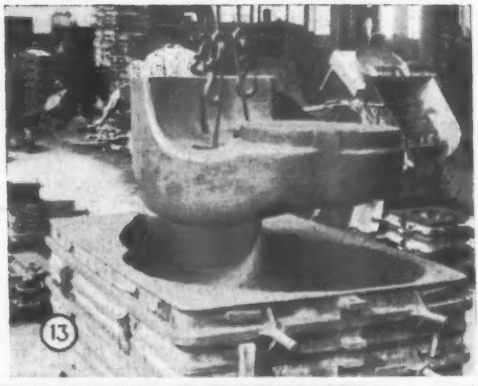


FIG. 9.—*Inlet-bend Cores formed in a Similar Manner to the Volute Cores.*

FIG. 10.—*Inlet Corebox Stripped.*

FIG. 11.—*Bottom Corebox, with the Core-grid Stamped-out.*



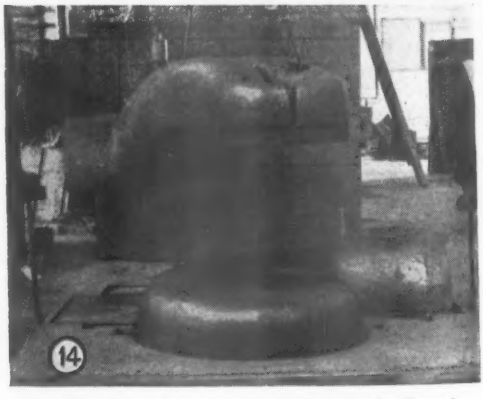


FIG. 12.—*One of the Coreboxes in use; the Dowel-locating Cross-piece is in Position, as are the Loose-pieces.*

FIG. 13.—*Completed Core being withdrawn.*

FIG. 14.—*Cores Grouped prior to Assembly; note the Locating Dowel.*

cores, the mould was thoroughly cleaned out and retouched before returning to stove for final drying. The procedure for each half was almost identical.

Temporary "Boxes" for Main Cores

Although the Author has previously registered his mild disapproval of the above technique, in all fairness one must admit that castings made by this method show an excellent regularity of metal thickness. Any lack of enthusiasm on the Author's part was entirely due to the fact that six were required, and the moulding time which was in consequence involved in apparently needless repetition, coupled with a call requesting speedier delivery. Several alternatives were then considered and finally it was decided to use the first set of cores as patterns in the construction of "home-made" or "utility" coreboxes. This involved no great loss of time and the cores were ultimately used for the first casting. This "utility" corebox for the discharge volute is shown in Fig. 8. The discharge-volute coreboxes presented no difficulty, being flat-backed; the half-cores were rammed up in a suitable moulding box not in regular use, spare dowels being provided to retain accurate location. The boxes were then turned over, strickled level and the cores withdrawn. These were finally sprayed with gum-water and blackwashed to a fine hard finish. Fig. 8 actually shows the coreboxes in use as visualized.

Inlet Bends

While not as straightforward as in the previous case, inlet-bend cores were similarly rammed up, turned over and a parting formed, following the dip of the bend and leaving a 3-in. land all round. The object of this, as will be seen from Fig. 9, was to provide ample bearing for the plaster of paris shells or loose pieces forming the bend, the bearing rings, and locating the webs. The core was completed in two sections, the casing and cover respectively. Preliminary to making the plaster casts, the cores and walls of the parting were lined with oiled paper and two pieces of wood were set up at the proposed joint. The plaster for the first half was then poured in slurry form and the walls were swept up when it was in a plastic stage, to an approximate thickness of $\frac{1}{4}$ in., the whole being reinforced with scrim or tow. Lifting irons were inserted and strickled level with the mould face or, to be precise, the corebox face. On drying out, the joint pieces were removed, the joint face shellac-ed and oiled and the second half or cover section was completed in a similar manner, a crosspiece with dowel location being marked off between both halves. Finally, the loose pieces and cores were withdrawn, the coreboxes finished as previously described and the loose pieces smoothed off and shellac-ed. Figs. 10 and 11 show respectively the top-inlet corebox stripped and the bottom corebox with core-grid stamped out.

In actual fact, these utility coreboxes, with reasonable care, worked most efficiently. Fig. 12 shows one of the coreboxes in use with loose pieces and dowel-locating crosspiece in position, and Fig. 13 the completed core being withdrawn from the corebox.

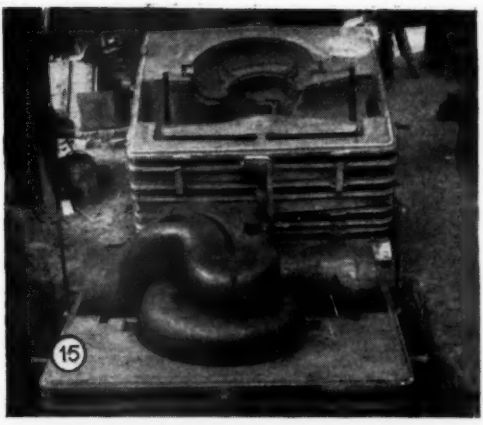


FIG. 15.—*Cores Assembled before closing the Mould.*

FIG. 16.—*Perforated Pattern-plate, Suitable Patterns, and examples of Castings Produced.*

FIG. 17.—*Pattern-stone Plates and Typical Castings Produced.*

Apart from slight discrepancies at the joint-faces of the cores, easily rectified on assembly, this method proved to be a sound practical proposition. Fig. 14 shows the cores grouped and Fig. 15 the complete

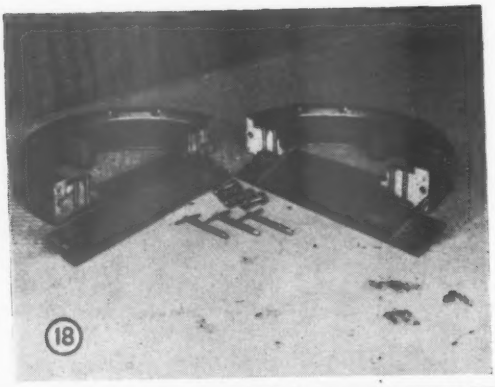


FIG. 18.—*Tackle for the Third Method of Preparing a Pattern-plate.*

FIG. 19.—*Equipment assembled for Making Mitre-Wheel Pattern-plate.*

FIG. 20.—*Half-moulds prepared for the Mitre-wheel Pattern-plate.*

assembly prior to final closing. The method chosen also allowed an additional man on the job; reduced the moulding to a straightforward operation; considerably speeded-up delivery and effected a saving of approximately 25 per cent. on total hours. The finished casting was up to normal standard and compared favourably with any made by the orthodox or routine clay thickness technique.

Semi-repetition Casting

As the jobbing foundry normally fills the gap between the specialized heavy foundry and the mechanized repetition establishment, it follows that to it also falls the job of making the light- to medium-weight casting with the modest number off, say, the recurring 50 or 100. Hence one finds most jobbing foundries to-day aspiring to some form of mechanization, however humble. In the foundry where the mechanization has gone so far as the installation of a moulding machine, it is soon realized that the problems which follow can be both many and varied. Foremost of these in the Author's foundry and one which he is quite sure is shared by many small foundries, is the adoption of customers' loose-patterns for machine moulding, especially when no patternshop is included in the set-up or where, in all probability, the cost of a first-class pattern-plate would be prohibitive. Again, the alternatives are numerous, but as the expense has generally to be borne by the foundry itself, costs are the determining factor and with these in mind, two of the methods in general use in the Author's foundry may be worthy of passing mention and a third of a little more elaboration.

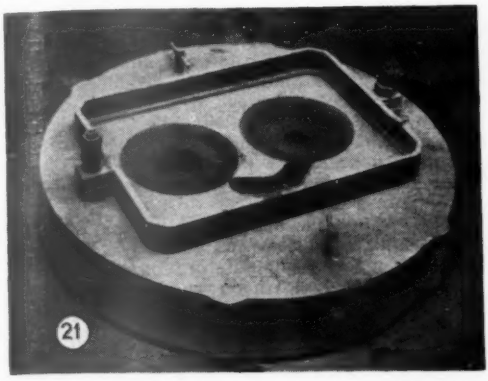
Perforated Pattern-plate and Plaster Patterns

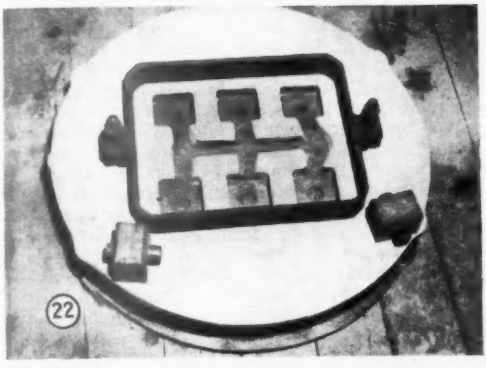
Of the first two, the perforated plate, with holes drilled parallel to fixed centre-lines on the plate, lends itself ideally to the split pattern of regular design and entails little or no expense. Fig. 16 shows a perforated pattern-plate, with examples of the patterns which are mounted and castings produced.

The second method is generally resorted to when the pattern does not fall into the first category. It is by no means expensive and follows the usual practice of moulding the job in the normal manner, or transplanting small patterns if necessary, locating suitable frames on the pin centres and casting top and drag pattern-plates using one of the proprietary gypsum cements as a medium, metal-insert patterns being built into the mould if the design be of a delicate nature. Fig. 17 shows cement pattern-plates with examples of production from them. While this method is very satisfactory and commendable for a wide variety of work, the disadvantages will be apparent. Completed moulds cannot be produced without changing plates and where the system calls for frequent casting this changing of plates can be exasperating and if combined with restricted floor-space or supply of moulding boxes, does not tend to a smooth production flow.

Third Method

Having in mind due consideration of the





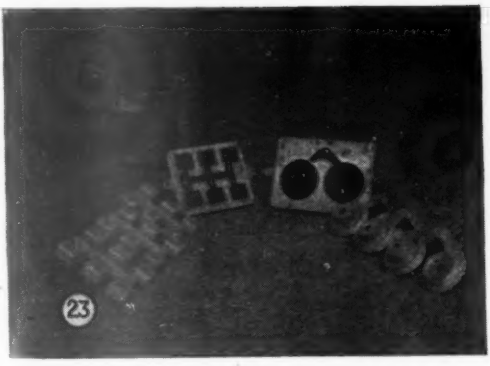
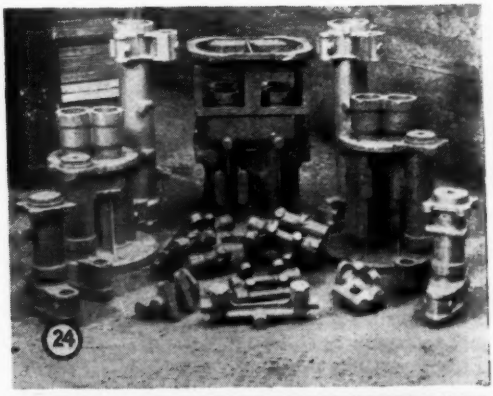
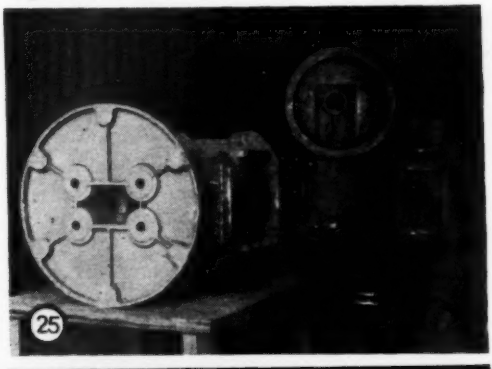


FIG. 21.—*Moulds assembled ready for Pouring the Pattern Stone.*

FIG. 22.—*Valve-nut Layout for a Stone Pattern-plate.*

FIG. 23.—*Stone pattern-plates made according to the Third Method and Castings produced.*





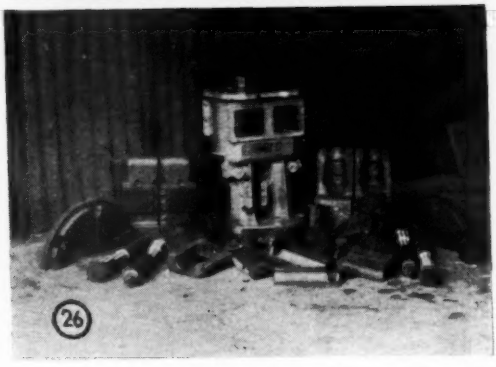


FIG. 24.—*Variety of Pressure-resistant Castings used in the Telemotor Installation of Ships' Steering Gear.*

FIG. 25.—*Duplex Cylinder-block Casting from the Bottom End.*

FIG. 26.—*Pattern and Complete Set of Cores for the Duplex Cylinder-block Casting.*

disadvantages in the jobbing foundry, the Author presents a third method, for which no originality is claimed. In the Author's opinion, where work involving two or more patterns in a box has to be considered, what follows is an ideal method and any initial outlay involved in the necessary equipment would be a sound investment and a most useful acquisition in any foundry. Fig. 18 shows the equipment for the third method of mounting loose-patterns for moulding. Simple in design, but

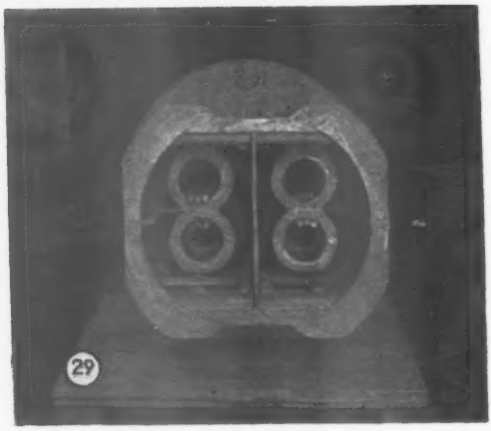


FIG. 27.—*Drag-half of the Cylinder-block Mould with Runners and Chills in Position.*

FIG. 28.—*Top-half of the Cylinder-block Pattern after Risers and Chills have been placed.*

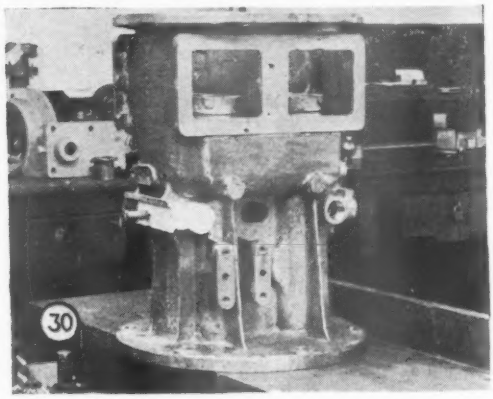
FIG. 29.—*Top View of the Casting with the Chills Still in Place.*

FIG. 30.—*Faulty Cylinder Casting with Defective Area marked.*

needing to be accurate in machining and location, this equipment has the decided advantage that, irrespective of number of patterns, irregularity of lay-out or design, it automatically produces a plate common for tops and drags, with the top and drag impressions accurately located and equidistant from the centre-line. In consists of two half-circular moulding boxes, with detachable faceplates and pin-locations, both on and at right angles to the centre-line.

Fig. 19 shows the box assembled and in use for a pattern-plate with two mitre wheels. While this is a comparatively simple illustration it is a typical example of the type of job where a solid pattern is generally supplied. The root of the boss on the average mitre wheel, being normally at a lower level than the outer edge, renders it an unsuitable subject for a split pattern on the perforated plate. Using the equipment as a normal half-circular moulding box, top and drag, with pin locations at three points, the mitre wheel was moulded in the usual manner, parted and both halves laid out on good level surface, and Fig. 20 shows this stage. On removal of the face-plates the two halves were moved up to meet, being accurately-located on pins at the centre-line, and firmly bolted in position. Fig. 21 shows the completed mould with the frame located ready for pouring the pattern-stone. Gates were then cut, the mould finished and brushed with Terraflake; a suitable frame was located on the pin centres—in this case across the parting—and the job was cast in plaster of Paris or one of the proprietary gypsum cements. (Some of the latter give a good life and are quite suitable for a moderate jolt machine.) After drying-out, the plate was stripped, trimmed and fine sand-papered where necessary, particularly the perpendicular surfaces such as the boss. It finally received two or three thin coats of shellac, before being submitted for a proof casting.

While this particular illustration shows the use of the frame across the parting line with only two castings per box, Fig. 22 shows a valve-nut layout parallel to the parting line, and incorporating six chamfered valve-nuts with the frame located *on* the parting line. Both are simple illustrations demonstrating the adaptability of the system, which



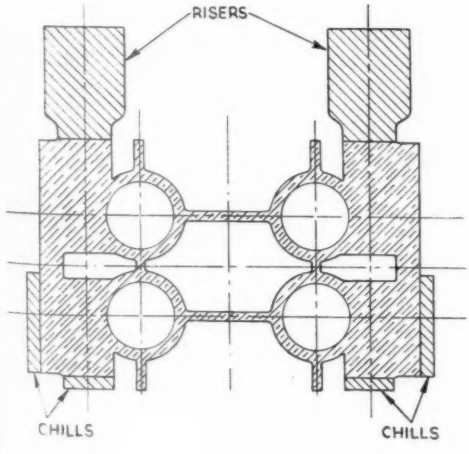
is equally effective with patterns of much more complex or involved design, and Fig. 23 shows examples of pattern-plates and castings made from them. The method, like most systems, has its limitations and admittedly would have no attraction for the mechanized foundry or for castings with a very high degree of accuracy. Nevertheless, in the Author's opinion it supplies the answer to a few of the jobbing foundry's problems in this particular sphere.

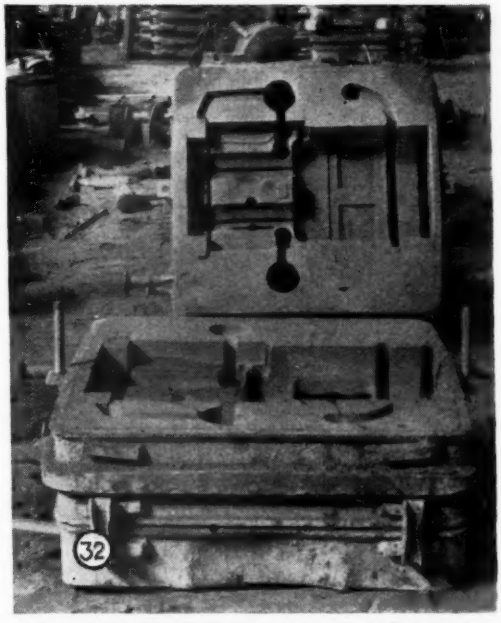
Pressure-resisting Casting

Relaxation or lassitude is a luxury in which very few foundrymen can afford to indulge at any time, and least of all those foundrymen dealing with pressure-resisting castings. In the jobbing foundry where, more or less, every casting has to be considered on its individual merits; where castings in which every boss, web or change of section can be a potential source of trouble, calling for consistency in moulding and metallurgical conditions, the making of a pressure-resisting casting calls for very careful consideration. Fig. 24 shows a variety of pressure castings, used in the telemotor installation of ship's steering gear, and while most of the castings shown are of a set type allowing for some measure of standard practice, there is also shown (centrally) a casting of a rather complex design. It is one of a batch of six made in the foundry referred to earlier and a description gives some idea of the troubles and difficulties likely to be encountered when dealing with castings of this type.

Moulding and Pouring Method

The casting is a duplex cylinder-block, weighing 2½ cwt., cast to L.G.3 alloy specification, and is shown in Fig. 25. As the title "duplex cylinder" would suggest, this casting is a duplication of the normal or standard-twin type of transmitting cylinder used in this class of work and incorporated four cylinders of $\frac{5}{16}$-in. wall thickness, with a variety of attached bosses and facings. The general design of this block made the producton of a sound, pressure-resisting casting a job which called for extreme care. It was, therefore, arranged with the engineering shop to cast only one and to await final machining and pressure testing before proceeding with the balance of the order—an arrangement normally to be recommended. Fig. 26 shows the pattern and complete set of cores, 20 in number, involved in the job. It was moulded in dry sand in a two-part moulding box. The running system adopted was carefully considered, particularly in





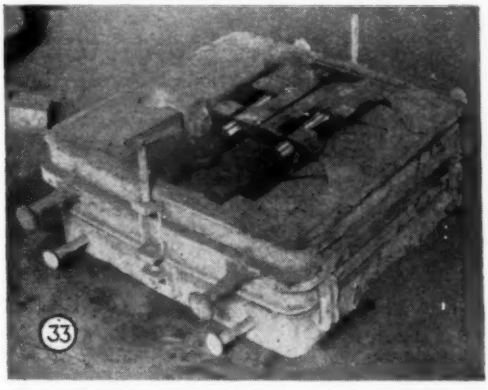


FIG. 31 (*left*).—*Section through Cylinder Castings, showing Position of Risers and Chills.*

FIG. 32.—*Cylinder Mould with Modified Gating System.*

FIG. 33.—*Mould with One Pair of Cylinder Cores in Place and with Chills Marked.*

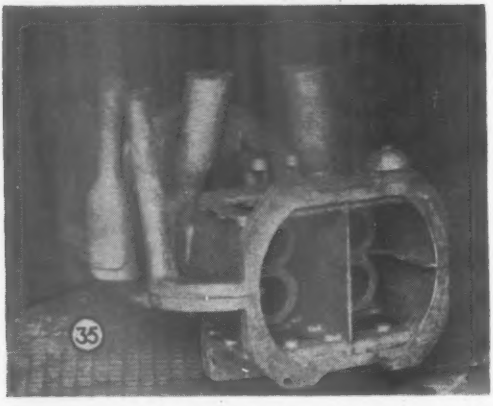


FIG. 34.—*Mould with Second Pair of Cylinder Cores in Position and ready for Closing.*

FIG. 35.—*Casting for the Cylinder Block, with Gating System still Attached.*

relation to the aforementioned bosses and facings. Finally, it was decided to gate on the light section and to chill the heavy sections, with risers where practicable on the top. Fig. 27 shows the drag-half of the pattern with the runners and chills in position, and Fig. 28 the top half of the pattern with risers and chills in position. Two downgates from a common head-box were provided to give an even distribution of metal. Furthermore, on the internal cores at the junction of the cylinders, where, naturally, there was a slightly heavier section and provision for feed metal was restricted by the position of the cylinder cores and the jacket core surrounding them, chilling had to be resorted to. Fig. 29 shows a top view of the casting with the chills in position.

Defects Discovered

Relative to the precautions taken, at this juncture it should be pointed out that each cylinder was subjected to an individual pressure of 2,000 lb. per sq. in., the slightest leakage from any one cylinder to the other was sufficient to condemn the casting. The prototype casting was completed along the lines indicated, cast at approximately 1,180 deg. C., and ultimately passed final inspection and pressure test without complaint. The balance of the order was therefore executed in a similar manner. Under happier circumstances, this would have been a fitting conclusion to the story of the duplex cylinder-block, but no one regrets more than the Author that, in the interests of truth, he has to record that all the other five were rejected, through "leaking on pressure test." On making inquiry at the machine shop, the foundry was informed, not without some other pointed remarks, that the castings were leaking "all over," the inference probably being that the same care had not been exercised, as in the case of the first casting. This suspicion was possibly quite justified on the evidence, but it was not very helpful to the foundry. In the face of this and the reigning national shortage of non-ferrous metals, ingot supplies were immediately suspect and a decision made to proceed with two castings, retaining the same gating system, increasing the chills at cylinder junctions and using virgin metal. On final test these two castings were also found to be leaking slightly in the area of the by-pass connection, but on only one cylinder. Fig. 30 shows a finished casting with the faulty area marked.

It was then learned that the previous castings had all shown a similar weakness and the fact that it did not always appear in exactly the same spot had given rise to the uninformative expression "Ach, they're leaking all over." This was, perhaps, excusable when one considers that to the engineer all four cylinders were alike; to him there was no top row

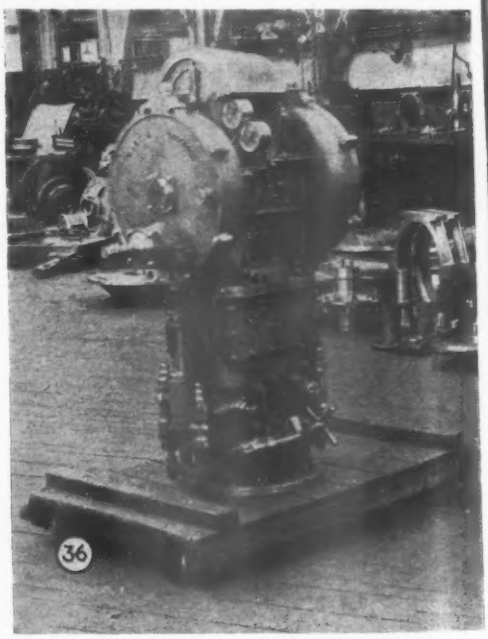


FIG. 36.—*Completed Duplex Engine after Final Assembly.*

or bottom row, no question as to whether it was on the ingate side or otherwise; it was just a bad casting. To the foundry, however, the very consistency of the faulty area was rather significant and on further investigation it was found that the faulty portion was one of the lower cylinders, and, actually, the one adjacent to the runner. Fig. 31 shows a sectional view of the casting through the by-pass connections showing risers and chills.

To err is human, and to be wise in retrospect is another human frailty. It now appeared quite obvious that the chills on the by-pass connection adjacent to the runner were being superheated by the flow of metal and thereby lost their efficiency. With no other provision for controlling liquid shrinkage, porosity in this area was inevitable. In view of this, the chills were removed and the running system modified to gate directly on to the by-pass connection with ample provision of metal being made for liquid shrinkage. Fig. 32 shows the mould with a modified gating system; Fig. 33 a mould with this system and one pair of cylinder cores in position with the chills marked; Fig. 34 shows another view of the mould with the second pair of cylinder cores in position and ready for final closing, while Fig. 35 illustrates the casting with the gating system still attached. Still proceeding with caution, this last method proved to be satisfactory and the replacement castings plus a further two-off were successfully completed in this manner. The finished engine is shown in Fig. 36.

While the finish on such units is normally one of paint or cellulose, this particular "customer" must be a firm believer in the axioms, either that "paint covers a multitude of sins" or "Satan finds some mischief still for idle hands to do," for he specified a burnished finish, calling for a first-class surface finish on all castings. On reflection, it would seem that the lesson to be drawn from this example of foundrywork is that a modest change in tactics often proves to be the most informative way of approaching such a job, and that the margin between success and failure is so very often a matter of fine detail.

(To be continued)

House Organs

Sif-Tips, Vol. 14, No. 76. Issued by Suffolk Iron Foundry (1920), Limited, Stowmarket.

This issue follows the usual pattern, except the "Overheard in the Train" has disappeared. Bell describes the mending of fractured bed-plates at a Stoke-on-Trent pottery. Mr. L. J. Tibbenham's early recollections of Ipswich are very human and very interesting.

Foseco Foundry Practice No. 105. Published by Foundry Services, Limited, Long Acre, Nechells, Birmingham, 7.

This issue carries an article dealing with a defective manganese-bronze propeller and a further one on "Some Notes on Aluminium/Silicon Alloys." This issue also announces the organization of a short paper competition.

U.S.C.O. Magazine, December, 1951. Published by the Union Steel Corporation of South Africa, Limited, Vereeniging.

This issue tells of the installation of a new 10-ton Elco furnace in the Klip Works where it will be engaged on the making of miners' drill steel. Before acceptance, the article states, 3,600 electrical checks had to be undertaken.

Crossley Chronicles, No. 147. Published by Crossley Brothers, Limited, Manchester, 11.

This issue tells of the award of no fewer than 18 gold watches to employees who have served the firm continuously for over 50 years. The doyen of the recipients was Mr. J. Bretnall of the foundry with 65 years' service. It is interesting to note that half of these stalwarts were from the foundry department.

Carron Cupola, Vol. 3, No. 1. Issued by the Carron Company, Falkirk, Scotland.

This issue announces the retirement of Mr. H. Metcalfe, the deputy manager of the company for the past nine years. He joined Carron in 1903 and was given progressively important positions. A second official to retire is Mr. H. Carbarns, C.A., the company's "book-keeper." He had been with Carron for 29 years. At a ceremony both these gentlemen were the recipients of gold wrist watches. The new appointments announced are that Mr. E. J. Leaver is to be assistant manager and Mr. A. C. Langmuir the chief accountant.

Albion Works Bulletin, Vol. 1, No. 1. Issued by John Harper & Company, Limited, Willenhall.

This issue is full of interest. There is reported an accident involving foot-burning to a man who always wore his spats when travelling to and from his home, but immediately removed them on starting work! The Bulletin also reports that the tonnage of castings made was a record production during the last quarter. The scrap was at a low record, also, being of the order of 6.25 per cent., whilst customer returns (and this for the highest quality of grey-iron castings) was 0.8 per cent. on an output of 2,000 tons. These are noteworthy figures and everybody concerned is to be congratulated.

Nickel Alloys, No. 16. Published by Henry Wiggin & Company, Limited, Wiggin Street, Birmingham, 16.

This issue contains a description of the new Rover lightweight gas-turbine, in which Nimonic alloys are employed, and articles on wire-cloth manufacture, chemical valves and the mag-nickel fuse. An interesting inclusion is a photograph of a model made to celebrate the discovery of nickel two hundred years ago. This model was seen by thousands at the Engineering Exhibition last September and then flown to Detroit where it was one of the attractions of the World Metallurgical Congress in the following month. A section of the model is the cover illustration of the present issue. Copies of Wiggin Nickel Alloys may be obtained by readers on application to Birmingham.

The Midland Section of the Institute of Vitreous Enamellers is holding a dinner/dance for members and their ladies on March 14 at the Star and Garter Royal Hotel, Wolverhampton, 7 for 7.30 p.m., informal dress. Tickets, price 17s. 6d. each, may be obtained on application to the secretary, Mr. D. Sleath, c/o Borax Consolidated, Limited, 87/89, Edmund Street, Birmingham, 3; attendance is limited to 120.

Book Reviews

Chill-cast Tin Bronzes. By D. Hanson, D.Sc., and W. T. Pell-Walpole, D.Sc. Published by Edward Arnold & Company, 11, Maddox Street, London, W.1. Price 75s. net.

This book covers the field of chill-cast tin bronze very thoroughly and contains much data and exceedingly valuable information for many branches of the foundry industry. It is written from the metallurgical standpoint but certain of its chapters will be readily understood by practical men. For instance, chapters IV to VIII, covering melting and casting processes, are indeed very interesting, and much of the material contained is applicable to sand casting of bronze. Unfortunately, the price of this book will be beyond the means of many interested persons. No serious criticisms can be made, as it is only too evident, on perusal, that this book is the result of a great deal of research and experiment, and, although expensive, is well worth the cost, as in the reviewer's opinion it gives the necessary information to foundry technicians and metallurgists so that they may discard old methods and install new processes in order to produce gas-free bronze of the highest quality.

The book covers 13 chapters, is well illustrated, and contains numerous references. A point well worthy of note is that at the top of each page are sub-headings covering the subject therein. Chapter I gives a very interesting history of the development of bronze founding from the Bronze Age to the present day, and when one reads that a bronze bell weighing 193 tons was cast for the Kremlin in 1733 and a 10-ton bell for Strasburg in 1375, one marvels at the quality and craftsmanship of olden days. The following 34 pages deal with methods of assessing the quality of cast bronze, including visual inspection, fracture (which is correlated with mechanical properties), microscopic examination and densities. This is a very useful chapter. Although its preface states: "This chapter is purposely written for the practical foundryman," it should have said for the foundry metallurgist or technician, for how many purely practical men are interested in microscopic examination or photo-micrographs? The following chapters, III to VIII, cover the institution of bronze melting and casting processes, segregation, properties of chill-cast bronze, effect of impurities, heat-treatment of cast bronze, and finally, the fabrication and properties of wrought bronze.

The melting and casting of bronze is of interest to all foundrymen, and this subject is dealt with very extensively, illustrating the best methods of alloying, deoxidizing and degassing bronze alloys, the production of chill-cast bars, bushes and billets of the greatest density and the highest properties by slow-pouring methods combined with the use of metal cores, for direct manufacture into bearings, etc., and billets for subsequent hot-rolling or extrusion.

One cannot praise this publication too highly, as it symbolizes so well in its field the motto of the Institute of British Foundrymen—"Science Hand-in-hand with Labour." R. F. H.

Gears, Spur, Helical, Bevel and Worm. By P. S. Houghton, A.M.I.Mech.E., published by the Technical Press, Limited, Gloucester Road, Kingston Hill, Surrey, price 50s.

To the engineer who does not require to delve deeply into the mechanics of gearing this book will be of value but its scope does not embrace many of the problems encountered by the technician as it deals somewhat superficially with both the technical and descriptive sides of the subject. It represents a useful collection of extracts from both British and American Standards on gearing together with information supplied by leading gear manufacturers with which the student or engineer interested in gear design and manufacture should be acquainted. The chapters dealing with gear cutting and inspection methods are commendable, being amply illustrated with photographs of modern gear-cutting and inspection machines.

To satisfy the enquiring mind of the student, the derivation of the bevel-gear factor (by which the permissible horsepower formulæ for spur and helical gears are rendered applicable to straight and spiral bevel gears) might have been analysed. Similarly the derivation of the interference factor used in the British Standard method of tooth correction for bevel gears might have been discussed. Spiral bevel gears of the type shown in Fig. 33b exist only in the imagination and on page 8 something has obviously gone wrong with the definition of helix angle as applied to worm gears: the angle referred to is the complement of the helix angle shown in Fig. 46. This confusion is repeated on page 13 in the definition of spiral angle. The absence of adequate lettering on Fig. 77 suggests that the diagram is incomplete; indeed, the editing is not of the standard which one expects to see in a book of this price.

In all subjects there are accepted classical works to which experts and novice alike may refer for guidance; gear design is no exception in this respect. No one book however contains all that can be said on a subject such as this and the reviewer feels that this is a book that will be a useful addition to the library of those concerned with the design, manufacture, application or maintenance of gear drives. F. W.

The Science of Flames and Furnaces. By M. U. Thring, M.A. Published by Chapman & Hall, Limited, 37, Essex Street, London, W.C.2. Price 42s. net.

This book deals with the fundamentals of industrial flames and furnaces. There are seven chapters dealing with construction and function. These are scientifically treated and stress the use of thermodynamics. Foundry furnaces have not received any special attention and, probably because they are a recent innovation, the use of carbon blocks in blast-furnace practice has not received mention. Perhaps in a new edition, the Author will include some study of the very interesting hot-blast, water-cooled and basic-lined cupolas. The Author being head of the physics department of the British Iron and Steel Research Association, is the organizer of co-operative research on flame radiation being carried out in Holland, and the results obtained are recorded in three chapters.

This book not only is undoubtedly an excellent text-book for undergraduates specializing in fuel technology, but also for technicians in the metallurgical and ceramic industries. Its 416 pages are liberally illustrated with clear, well-produced diagrams, whilst the letterpress is particularly clearly written.

Lead Toy Casting, by G. F. R. Lead, F.R.S.A. Published by E. A. Mortimer, Limited, 215a, Uxbridge Road, W.13. Price 2s. 6d. net.

This very clearly illustrated little text-book, describes the making of lead-toy castings both by the slush and gravity casting processes, whilst for those more advanced in the art, information is given on mould making. Never having practised the art, the reviewer is unaware as to the availability of the dies, but if they be difficult to obtain, a note might usefully be included as to the source of supply—even though it read "any good toy-shop." Any reader thinking of taking up this hobby would be well advised to buy this little book.

Patternmaking and Production

The November meeting of the East Midlands branch of the Institute of British Foundrymen heard Mr. S. A. Horton repeat his lecture on "Patternmaking as an aid to Production Moulding and Coremaking." A very practical discussion followed from which the following abstracts have been taken.*

MR. H. P. MILLAR asked why copper was selected for corebox inserts.

MR. HORTON replied that copper was a very efficient material because it was easily hand-worked to the required shape, and the service life compared very favourably with steel.

MR. PERRY asked whether Mr. Horton preferred a brass pattern or an iron pattern for an established quantity-production job. Was there a danger of corrosion and was the brass or bronze made to any particular specification?

MR. HORTON replied that much depended on whether the pattern was likely to be subjected to serious wear in the particular foundry in which it was used, that was, rough wear. A better life from cast iron would be obtained as against brass, but repairs to cast-iron patterns were more expensive. Providing there was little likelihood of abusive wear, cast iron would prove the more satisfactory, but the initial cost was greater. When in continuous use, the fear of corrosion could be ruled out. The brass used was to no definite specification.

MR. PERRY referred to air-release vents for which purpose the only type available was the copper or brass slotted type. He understood the Americans used steel-mesh type which did not clog.

MR. HORTON said his firm invariably used the slotted air-release vent. As to clogging, with aluminium boxes, they kept a large tub of water adjacent to the machine, and coreboxes in continuous use were put in water overnight, and blown out the following morning, and no trouble was experienced with clogged vents.

MR. HAYDEN took up the question of a double-flanged hub using a modification eliminating one flange entirely. Was the modification done to eliminate the large ring core which would have been necessary, or did the change make it a better moulding proposition?

MR. HORTON said the modification of the hub casting was undertaken with the object of eliminating the cost of the core.

Value of Planning

MR. ROXBURGH stressed the importance of planning, as it paid handsome dividends. A job studied at the inception in all its details would yield successful results. Excellent patterns were received from the pattern-shop, and the foundry executives were responsible for the methods adopted. At the same time, it was always insisted that the pattern-shop, in addition to making tapers on prints, also gave taper on the patterns. With the push-off machine, or the stripper machine, it was necessary to have adequate taper in order that the pattern would draw easily. With regard to stripping machines, the outside profile of the plate was machined. The actual steel strips on the plate, were, in fact, 0.010 in. above the surface of the plate, in order that there was a sand-to-sand joint. He then emphasized that once a good set of patterns was provided they needed proper maintenance. On running lines, pattern heaters were used, and this helped in the preservation of the pattern, particularly by eliminating corrosion. It was amazing the depth of cod it was possible to lift if resort was made to pattern heating. Another point was that having been provided with an accurate pattern, it was encumbent on the foundry to follow-up and ensure that all the box-pins and removable pattern-pins were to dimension; they should be checked regularly by gauges, and at a certain stage of wear, they must be scrapped and replaced. It was useless to spoil the accuracy of the job by neglecting the inspection by gauges. Patterns and coreboxes should also be inspected every week. It was found (particularly with coreboxes for blowing) that the wear on the corebox could be very great and without regular inspection, castings might have to be scrapped.

Carrier and Half-corebox Method

MR. CAMPBELL asked for Mr. Horton's comments as to the possibilities of blowing a core with a core shell carrier and a half-corebox, leaving the core in the carrier. Apart from expense, were there any other disadvantages? Considering the danger of allowing sand to pass through the joint of the corebox, did the same problem exist on the seating of loose-pieces?

MR. HORTON replied that from the patternmaking point of view, apart from expense, there was no reason why the half-box/half-shell-drier arrangement could not be operated; it was used extensively in the United States. There was increased expense necessitated, in that many additional half-coreboxes would be required for use as shell carriers. Mr. Fearfield would probably answer from the core-shop angle.

MR. FEARFIELD said there was no real reason why one should use this method, except where there was a complicated core which would require a vent in the half-corebox to be used as a shell carrier.

MR. HORTON referring to the use of loose-pieces, said that to prevent sand escaping he did attempt to enclose fully all loose-pieces.

MR. CAMPBELL asked whether the loose-pieces wore more rapidly than the corebox.

MR. HORTON said that it was dependent on the actual loose-piece, and declined to give a definite answer.

Provision for Maintenance

MR. LEWIS stressed the importance of a shell

* Printed in the JOURNAL January 5, 1950.

Patternmaking and Production

carrier in keeping the shape of the core, asked whether the shell tended to distort, and what was its average life.

MR. HORTON said it was difficult to say what was the average life of a shell. His firm arranged for all shells to be checked at frequent intervals. If they were shown to be defective, and if they could not be rectified by straightening, they were scrapped.

MR. RADFORD asked whether blown cores required more finishing as compared with hand-made cores.

MR. HORTON replied that providing the corebox was correctly prepared and maintained, there should be no finishing necessary. There were persons engaged on finishing cores, but providing maintenance of the box was controlled, there was no reason why a perfect core should not be blown each time.

Shell Carriers

A MEMBER asked whether there was any provision made for rapping. How did one remove the core from the shell after baking? Were any strengthening parts provided?

MR. HORTON replied that the core shell was usually designed with suitable supporting ribs, and invariably a rib could be used for rapping out the core, if there was a tendency for the core to stick. Shells were always prepared to support the "green" core most accurately.

MR. PERRY asked whether Mr. Horton considered it an advantage to blow a core through the bottom of the box directly on to the shell carrier, and so save turning over; this would save time and prevent distortion in turning over.

MR. HORTON said that providing the shape of the core was suitable, there was no reason why it should not be blown from the bottom. The box would support the core until it was stripped, and the core would then be standing on a flat core-shell plate.

Core Turnover

MR. P. A. RUSSELL asked whether difficulties were experienced in turning over when using large boxes. Was there not a quick device to secure the shell to the half-corebox while still in use, clamp together, and roll over?

MR. HORTON said the corebox and shell were rolled over by hand. In the States, he understood, they had a machine whereby the top part of the box was stripped with the machine, saving time in stripping the top-half of the corebox.

MR. ROXBURGH commented that in America they had a machine for turning over heavy cores.

MR. FEARFIELD pointed out that the practice was not to suspend the boxes in mid air. They were laid on the side of the table and rolled over.

MR. J. HILL said he understood that in the States they had discontinued the use of the machine for turning over cores, and found it easier to turn them over by hand.

MR. LEWIS asked what governed the hardness of a blown core. Was the hardness very important?

(*Continued at the foot of col.* 2)

MR. FEARFIELD said the hardness was very important, otherwise a core would sag. It was quite true one must have both necessary air pressure, and volume. Unless there was plenty of air available, one could not induce the sand in the air-stream into the corebox at the same pressure. This was the chief reason for having air receivers adjacent to coreblowers.

January's Steel Output Below 1951 Level

Figures released by the British Iron and Steel Federation show that January's steel output was at a level well below that of January, 1951. Pig-iron production continues to increase.

Production of steel ingots and castings in January was at an annual rate of 15,234,000 tons, which compares with a rate of 14,953,000 tons in December and of 15,907,000 in January, 1951. Pig-iron output last month was at an annual rate of 10,319,000 tons, against a rate of 10,281,000 tons in December and of 9,520,000 tons in the opening month of last year.

Latest steel and pig-iron output figures (in tons) compares as follow with earlier returns:—

	Pig-iron.		Steel ingots and castings.	
	Weekly average.	Annual rate.	Weekly average.	Annual rate.
1952—January ..	198,500	10,319,000	293,000	15,234,000
1951—January ..	183,100	9,520,000	305,900	15,907,000
November	196,000	10,194,000	316,100	16,437,000
December	197,700	10,281,000	287,600	14,953,000
1950—November	193,100	10,042,000	336,000	17,472,000
December	188,500	9,801,000	296,300	15,408,000

Japan to Stop Steel Exports to U.K.

Because it is thought that Japan should not increase her already large sterling balances, the Japanese Foreign Exchange Board has recommended to the Prime Minister, Shigeru Yoshida, that he should prevent the export of 109,000 tons of steel to Britain in exchange for sterling.

On January 30 the British Iron & Steel Corporation, Limited, signed a contract with two Japanese companies, Yawata Steel and Fuji Steel, representing a number of other private companies, to buy steel at a cost of about £5,000,000. Last week an official of the Japanese Trade Ministry said that no action had yet been taken on issuing export licences, but two of the companies had submitted applications for export, and three more were expected to lodge applications within a few days.

Steel Production in Belgium and Luxemburg

Belgian steel production in January totalled 449,510 metric tons, against 423,128 tons in December.

Production of pig-iron in Luxemburg was 273,851 tons in January, against 259,470 tons in December. The production of steel was 266,314 tons in January and 249,126 tons in December.

Central Foundry Division of the General Motors Corporation, Saginaw, Michigan, U.S.A.*

The malleable foundry of the Central Foundry Division of the General Motors Corporation at Saginaw, Michigan, is the largest malleable iron foundry in the United States and in the world. It is managed by Mr. Carl Joseph and it pours about 1,600 (short) tons of molten metal per working day and employs 2,900 workers. The following notes cover points of interest arising during a brief visit on October 16, 1951, with Mr. Blanc. The product is wholly blackheart malleable castings for automobiles.

General

The foundry is of impressive size and has four sand-preparation units and eleven conveyors. The atmosphere is good, water-washed air being supplied through down-comers to the pourers, and exhaust hoods cover every part of the conveyors and other equipment where dust or fume is being given off. A whistle signal will bring either an electrician or millwright for urgent repairs to keep the plant working. White and coloured people work side by side and get the rate for the job without discrimination. As with other G.M. plants, labour relations in the shop are organized through one union. A 16-hr. spell in two shifts is worked in the melting and moulding departments, but the heat-treatment section works on a 24-hr.-day basis with a seven-day week. A swing shift is provided to stagger the working periods of any particular operator. A five-day week of 40 hrs. is normal. It was rare to see men walking about in this plant, and the passage-ways are kept clear of all obstacles. Cleanliness and safety are notable features.

The company make for themselves and supply malleable components to makers of cars competitive with G.M., such as Ford, Hudson, Packard, and the assembly plants for G.M., such as Buick, Cadillac, Pontiac, Chevrolet, Oldsmobile, and the motor-lorry plants, appear to be equally free to buy components elsewhere if they can do so more cheaply or satisfactorily. The same town houses a large G.M. grey-iron foundry known as the Chevrolet foundry, which has an even greater output than the malleable plants, and was said to be melting 3,300 (short) tons of metal per day, for cylinder-blocks, -heads and pistons (of which the yield was 72 per cent.) with a total payroll of 6,500 on two shifts. The group has other foundries at Danville (Ohio), both grey and malleable, and Defiance for cylinder-blocks and crankshafts. All workers were required to eat in the cafeteria, whether or not they purchased their food there, and slot machines made both food and drink, etc., available readily.

Melting Practice

The melting plant comprises a battery of six cupolas, three of which are in operation at any one time on a 16-hr. run covering two working shifts. The working is duplexed, the metal being transferred to and raised in temperature in three 12-ton electric-arc furnaces. The three cupola furnaces produce 110 tons of molten metal per hour and are 112 in. outside diameter, with a melting zone of 85 to 87 in. Tapping is continuous into a 15-ton capacity forehearth. The refractory patching material is blown on by means of a gun made by Eastern Clay Products, Limited, but operators said that a gun made by Pyro Refractories was more robust. The forehearth was tilted to fill a monorail ladle holding three tons, for transfer to the electric furnaces, which were delivering one ton at a time for pouring. The latter operation was arranged by transfer to the pouring ladles holding about half a ton. By suitably staggering the cupola metal in relation to the electric-furnace operation, a maximum degree of homogeneity and uniformity was attained.

The cupola furnaces were water-cooled and the blast was heated to from 148 to 190 deg. C. by means of natural-gas brought from Texas, some 1,500 to 2,000 miles away. A higher temperature causes silica reduction and hence an undesired rise in the silicon content of the melt. The water in the 2-in. glands is at 40 lb. per sq. in. pressure and the lining put on is 6 in. thick, but they have some evidence that the refractory may be completely removed after six hours running. As the Saginaw valley can be very humid, the humidity of the blast is controlled at 47 grains H_2O per cub. ft. of air supplied. The metal leaves the cupola at 1,480 deg. C. at a rate of about 37 tons (short) per hour. The electric furnace adds about 33 deg. C. during the 90 secs. for which it is superheated. When the foundry starts up from cold the metal is taken from the cupola at a higher temperature.

The cupola charges comprise pig-iron, home scrap, steel scrap, limestone and coke (which is brought from Birmingham, Ala.) and ferro-manganese briquettes are used. The metal charge is kept constant at 10,000 lb. and the coke charge is normally 1,000 lb., more or less to suit the temperature requirements. While the charge weight of metal is kept constant, it may vary as to the proportions of pig and scrap.

Annealing

The bulk of the annealing is carried on in Swindell-Dressler continuous-type, controlled-atmosphere furnaces which complete the anneal in 30 hours. The furnaces are heated with natural-gas with 1.0 to 1.5 per cent. CO_2 and 18 to 25 per cent. CO. A tunnel furnace is also operated on a 60-hr. anneal, together with a surface-combustion furnace. The tunnel oven takes 60 cars of 24 boxes each and has run for over four years without a shut-down. It is understood that the tunnel furnace is to be superseded by additional Swindell-Dressler units and when present plans are completed, thirteen of these furnaces will be installed, of which 10 exist at present. All annealed castings are subject to a fluorescent light (Magnaglo) inspection for cracks. The castings are painted with the fluorescent solution (or suspension) and then examined in the ultra-violet lamp cabinet.

The annealing boxes for the tunnel-oven are of white iron made by a small foundry at Bay City; they have a life of 40 cycles. They contain no added chromium, but may have a low residual alloy content. Alloy trays for the oven furnace, made by Belle City Malleable, Racine, Wis., a steel foundry, are being tried, but it is not yet known whether they are economic. As they have to have five times the life of the white iron to be so, an estimated life of 200 is needed. So far, 180 had been obtained and it appeared likely that the required figure would be reached. The alloy is known as Duraloy (heat-resisting, high Ni/Cr steel).

* Report issued by the British Cast Iron Research Association.

General Motors' Malleable Foundry

The ordinary malleablizing cycle is to heat up to 950 deg. C., hold for 10 hrs., cool rapidly to 760 deg. C. and then slowly cool to 705 deg. C. at 5.5 deg. C. per hour. The total cycle is 30.66 hrs. The pearlitic malleable (Armasteel, made in Grades A and B, the former being the harder) is heated from room temperature to 950 deg. C., held for 10 hrs. and then cooled in stages from this temperature and is air-quenched from 900 deg. C. in a cycle of 27.5 hrs. It is then tempered for 8 hrs., the time/temperature relationship to obtain a given hardness being used to keep the time constant with varying temperature. To get the higher hardness required for Grade A, a temperature of 680 to 700 deg. C. is required, and for the lower hardness of Grade B, a temperature of 700 to 715 deg. C.

Production

Since the output of good castings is 46 per cent. of the metal cast, the daily tonnage of malleable is about 700, giving approximately 5 cwt. of castings per man per day, or 25 cwt. of malleable per five-day week. Of the balance of 54 per cent., some 6 per cent. is casting scrap and the balance runners and risers. Of moulds without cores, 75 to a maximum of 90 moulds per man per hour are obtained. Moulding sand is drawn 18 miles and supplied to a grain-size specification of 68 A.F.S. fineness; 300 tons per day are used. Spent core sand goes to the foundry supply and no new sand is added to that. Coreshop sand is oil-bonded, not with linseed, but with fish oil or synthetic oil. No fewer than 98 per cent. of the cores are blown and some ingenious arrangements were observed, permitting operatives to blow two boxes. Foundry sand carries coal-dust and a suitable clay (Southern bentonite), with the spent core sand. Patterns are purchased outside, but are repaired or altered when needed on the premises, this work requiring a quite elaborately equipped and large shop, in which all core-boxes are also made or repaired. Four kinds of sand are used, carried in nine hoppers. The coreshop had one horizontal and three vertical core ovens.

Laboratory control is exercised on a sample taken every 30 min. from the cupola iron and every 60 min. from the electric furnace, for carbon, silicon, manganese estimations, and the analyses are supplied in from 25 to 30 min. Sulphur and chromium are tested every two hours and phosphorus once a day. The desired composition is total carbon 2.55, silicon 1.4, manganese 0.45, sulphur 0.12, and phosphorus 0.05. The laboratory can duplicate the malleable annealing cycle used in the shop.

Properties

The standard material complies with the regular quality of A.S.T.M. specifications for malleable. A higher-grade material, a pearlitic malleable, known by the trade name Armasteel, is also made and is a high-quality blackheart, in two grades, A and B, also complying with requirements for A.S.T.M. pearlitic malleable.

An interesting feature was the production of rocker-arms for overhead valves, which the group supplies to several makers. The quantity produced made hardness testing troublesome, each arm having to fall within a tolerance band on a Rockwell hardness test. An electronic engineer was employed to devise an appliance which takes all the arms at the appropriate stage and automatically rejects the over- or under-hard and passes those within the tolerance band. It is based essentially on magnetizing the arms, the retained magnetism being a function of the hardness. Armasteel has replaced steel forgings in some cases and hence no shrink is allowable.

Developments

Considerable attention was being given to the possibility of shell-moulding and the whole details were being carefully worked out. It was said that six men were fully engaged on this development, and the process is almost ready to go into production. Since the research division of the same group had been seen at Detroit, it was of interest to learn that work passed to the research division by the manufacturing or assembly units of the group was paid for by the sponsoring unit.

Cores and Coreprints

By "Tramp"

It has been said that a patternmaker's "foundry sense" is revealed by the way in which he "prints" his patterns. The subject of cores and coreprints is a very wide one and in cases of doubt it is always wise for the patternmaker to consult the moulder before deciding on prints for new or out-of-the-way jobs.

Occasionally prints can be dispensed with altogether, but this method is only applicable to certain jobs, and the attempt to dispense with prints may often result in a costly job. An example is shown in Fig. 1 of a job which requires a large number of round cores. To print this pattern would be rather difficult, and as the holes are not required to be exact to very close limits—being simply for air holes in a fire baffle—another method can be adopted. This method consists of making the cores about $\frac{1}{16}$ in. longer on the small diameter and pressing them into the mould (Fig. 2), a gauge being supplied from the patternshop to ensure that the cores are low enough in the mould and thus will not "crush" on closing.

Fig. 3 shows a bad example recently encountered of a pattern supplied without a coreprint. The only indication of a core being required being the receipt of a corebox with the pattern and three painted places on the pattern at A. To position these cores it was necessary to get a piece of wood from the patternshop of depth B and rest the core on it and secure it by means of nails, a not very satisfactory method and costly in moulder's time. A drop print and corebox would not have taken the patternmaker very much more time when constructing the pattern equipment, but would have saved the moulder a considerable amount of work.

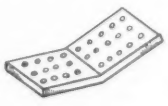


FIG 1

FIG 2

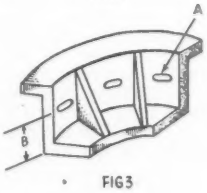


FIG 3

FIG. 1.—*Casting requiring Large Number of Round Cores.* FIG. 2.—*Cores Pressed into the Mould.* FIG. 3.—*Bad Example of Pattern supplied without a Coreprint.*

Copper Alloys for Die-castings*

By L. F. Spencer

Pressure die-castings made from copper-base alloys are not as extensively used as those in aluminium and zinc alloy. They can, however, be used to advantage where complexity of design is combined with high strength requirements. While pressure die-castings are less dense in grain structure than hot-pressed or forged parts, they are adaptable to a wider range of design. Intricate coring does not present any special difficulty nor do heavy sections with thin webs, thin sections with reinforcing ribs, or bosses.

The copper/zinc alloys are entensively used as pressure-die-casting material. Their casting range is in the vicinity of 920 deg. C. This high casting temperature presents many problems that still have not been entirely solved, especially as to the choice and life span of die material. Nevertheless, brass die-casting procedures are in commercial operation. The strength of the compositions often approaches 44 tons per sq. in., equivalent to the strength of some of the heat-treated alloy steels.

The basic compositions usually employed as die-cast material are listed in Table I. Alloys 1 and 2 are standard Anaconda alloys. Alloys A and B are covered by A.S.T.M. specifications. Alloy A is a general-purpose alloy of low cost with wide limits as to impurities. Alloy B is of higher purity and is capable of excellent castability and mechanical properties in the as-die-cast condition. Alloy 2 is harder and has better physical properties than alloy B and finds use where resistance to wear is required.

TABLE I.—*Copper Alloys for Die-casting*

Element.	Composition, per cent.			
	Alloy 1.	Alloy 2.	Alloy A.	Alloy B.
Copper ..	60.00	81.50	57.0 min.	63.0 to 67.0
Silicon	0.15	4.25	0.25 max.	0.75 to 1.25
Lead	1.00	—	1.50 max.	0.25 max.
Manganese ..	—	0.15	0.25 max.	0.15 max.
Tin	1.00	—	1.50 max.	0.25 max.
Aluminium ..	0.10	—	0.25 max.	0.15 max.
Iron	—	—	0.25 max.	0.15 max.
Other elements	—	—	0.50 max.	0.50 max.
Zinc	37.75	14.10	30.00 min.	Remainder

Mechanical Properties

The mechanical properties of both alloys A and B, as indicated in Table II, are usually minimum values. Reports from three laboratories concerning die-cast test-bars of these alloys, show an average tensile strength of more than 27 tons per sq. in. for alloy A and more than 35 tons per sq. in. for alloy B. The average yield strength reported was more than 16 tons per sq. in. for alloy A and more than 22 tons per sq. in. for alloy B. The average Charpy impact values were 20 ft.-lb. for alloy A and 30 ft.-lb. for alloy B. Alloy 2 is used extensively where high strength, hardness and resistance to wear and corrosion is desired. Die-castings of this composition outwear other hard materials in a number of applications, and this alloy has often replaced mild steel.

* Reproduced from *The Iron Age* by courtesy of its Editor. The Author is chief metallurgist Landers, Frary & Clark, New Britain, Connecticut.

TABLE II.—*Properties of Copper-base Die-casting Alloys.*

	Alloy 1.	Alloy 2.	Alloy A.	Alloy B.
Tensile strength, tons per sq. in.	24.5	37.9	20.0	25.9
Yield strength, tons per sq. in.	15.6	22.3	11.1	13.4
Elongation, per cent. on 2 in...	8.0	8.0	10.0	15.0
Charpy impact strength, ft.-lb.	—	40	30	40
Brinell hardness	—	170	120	130

* Yield point at 0.5 per cent under stress.
† At 0.2 per cent. offset.

Such copper alloys as aluminium-bronze, tin-bronze, and other high-copper alloys can be die-cast readily. However, their casting temperatures are usually too high for them to be economically formed by this method, because of their effect on die materials.

Leaded Alloys

Those alloys containing appreciable amounts of lead such as alloy 1 and alloy A have improved machinability. However, the addition of this element will result in formation of grey spots of metallic lead on the surface of the die-casting due to the tendency of this element to segregate. Lead will also contribute to hot-shortness or possible breakage in die-casting; it contributes to the oxide coating of the die, and may form in tiny globules in the grain-boundaries, causing intergranular weaknesses. Intergranular weakness is also attributed to such elements as bismuth and antimony which should be kept below 0.005 per cent. Tin, manganese and iron increase the hardness of the alloy. Tin, however, improves both corrosion resistance and surface finish, whereas iron reduces corrosion resistance. Both aluminium and magnesium are deoxidizers, but magnesium should be present in amounts sufficient to react with the oxides.

Silicon increases Strength

Aluminium, due to its effect in retarding oxidation and in the prevention of volitalization of zinc at the die-casting temperatures, has an impurity limitation of approximately 0.25 per cent. maximum. That specified for magnesium is usually 0.01 per cent. The superiority of alloy 2 in regard to its mechanical properties is due to the silicon content of the alloy. This element also lowers the melting point of the alloy, increases fluidity, and has a deoxidizing effect on the metal.

Both the vertical and horizontal type of cold-chamber machine can be employed in pressure die-casting brass alloys. The sectional thicknesses

Copper Alloys for Die-castings

which can be cast will vary; sections as thin as 0.070 in. can be die-cast if not over too large an area. Owing to the high melting temperatures employed in the die-casting of these alloys, heavy sections of ½ in. or more are not recommended due to the tendency to overheat the die, resulting in substantial loss in life. The maximum weight of a brass die-cast part is usually given at 5 lb.

Design Details

The inclusion of cast threads in a brass casting design is feasible provided the maximum number of threads per inch on external surfaces is 10 and the die is parted on the thread axis. Die-cast threads usually require a chasing machining operation, where close fits are desired. Internal threads cannot be cast.

Drafts on both cores and side walls are necessary, as is the case with the other die-casting materials. However, the specific values will vary; for the brass casting alloys, the minimum draft in inches per inch of length or diameter on cores and side walls is usually 0.020. Choice of proper draft values will not only aid in obtaining maximum die life, but also will aid in the ejection of the part. Where this draft value is too low, ejection may result in either distortion or marring.

Cores

One of the advantages of a die-casting process is the use of intricate coring of holes, slots and recesses. In the casting of holes, the minimum diameter feasible in brass alloys is approximately ¼ in. For brass die-casting alloys, holes that are smaller than 0.186-in. dia. need not be cored. Holes that have a diameter from 0.186 to 0.500 in. have a cored depth approximately 1½ to 3 times the diameter. For holes from ½- to 1-in. dia., the cored depth will vary from three to five times the diameter. Where deeper holes are encountered, it is advisable to core a portion of the depth.

Other Design Considerations

Other die-design considerations are also recommended. Small fillets should be used on both inside and outside corners where surfaces join, the only exception being in the parting plane where sharp corners may be employed. Production of teeth, serrations, splines and lettering should be confined to surfaces parallel to the parting line.

Although no die alloy has yet been found that will completely meet the service conditions presented in die-casting of brass, the best material so far is the heat-resistant tungsten-chromium-vanadium steel having 0.30 per cent. carbon, 9.0 per cent. tungsten, 3.0 per cent. chromium, and 0.45 per cent. vanadium. Usually the life of such a die, heat-treated to 50 Rockwell C. scale, is from 10,000 to 50,000 cycles, before replacement is necessary. Life varies with such factors as size, weight and wall-section of the casting. Another steel die composition within the same group is that containing 0.30 per cent. carbon, 1.40 per cent. chromium, 0.40 per cent. molybdenum, 4.0 per cent. tungsten and 5.0 per cent. cobalt.

New Italian Foundry Magazine

The first issue of "Fonderia," a new monthly Italian foundry magazine, is dated January, 1952. It is published from 19, Via Mameli, Milan, and costs overseas subscribers 5,000 Italian lire annually. It has been printed on pink paper, which, in the reviewer's opinion, is historically better suited for a racing newspaper than a serious technical publication. There is included a high-grade article on nodular cast iron by Professor De Sy of Belgium, and the micrographs used for illustrating it lose much on account of the coloured paper. The magazine opens with an editorial which sets out the objectives of the new monthly, and gives some indication of the field it proposes to cover—that is, the 1,200 foundries in the country. Following this, there is a study by Dr. G. Somigli on the possibilities of mechanizing Italian foundries. This is to be continued in future issues. Then follows Professor De Sy's article to which reference has been made earlier. Finally, there is a short article on materials for dies. We wish the new magazine a long and prosperous career in the service of the Italian foundry industry.

Latest Foundry Statistics

Last year, the production of copper-base castings amounted to 67,713 tons as compared with 46,888 tons in 1950. The copper content of the 1951 production was 54,171 tons. These figures are received from the British Bureau of Non-ferrous Metal Statistics.

New Companies in 1951

Last year 12,932 new companies, with a nominal capital of £94,781,886, were placed on the London register, relating to England and Wales. In 1951 13,278 new companies, with a capital of £67,762,072, were registered. Statistics compiled by Jordan & Sons, Limited, company registration agents, of 116, Chancery Lane, London, W.C.2, show that the average nominal capital was £7,329 in 1951, against £5,104 in the previous year. Twenty-six new public companies were registered in both 1951 and 1950. The combined capital on registration was, however, £23,653,601, compared with £1,226,725 in 1950.

Eight companies with a capital of £1,000,000 or more were registered last year, including British Oxygen Engineering, Limited and Ore Carriers, Limited, both with a capital of £2,000,000.

Liners for the Shipbreakers

A Clyde-built liner, the Union Castle's 38-year-old Llanstephen Castle (11,346 tons gross) is being withdrawn from service to be broken up and Clyde shipbreakers are interested in the contract. The liner was built by Fairfield Shipbuilding Company, Glasgow, and reconditioned by them in 1946-47 after her war service. Llanstephen Castle has just completed her last voyage from Beira. Also earmarked for the shipbreakers is the 21,833-ton Empress of Australia, built in Germany in 1914. She will shortly sail from Liverpool to Hongkong on her last voyage as a troopship.

British Bronze and Brass Ingot Manufacturers' Association

MR. G. W. BOOTH'S PRESIDENTIAL ADDRESS

In the course of his address given to the annual general meeting of the British Bronze and Brass Ingot Manufacturers' Association, MR. BOOTH said the Rhondda Metal Company, Limited, had joined during the year. The Association now represented a very substantial proportion of the industry making ingots and billets for sale.

Metal Supplies

A number of members expressed the wish that, in view of the scarcity of brass scrap, the council should approach the Ministry with a view to obtaining allocations of low-grade copper and spelter. This point was pressed to the utmost, but the Director of Non-ferrous Metals stated, very definitely, that no such allocations were possible, as supplies were insufficient for most urgent requirements. This was followed up by protesting against the practice which had become prevalent of fabricators insisting on the return of scrap and also against the system of bartering scrap for uncontrolled goods, such as rod, etc., which merely ended in depriving ingot makers of their legitimate source of supply. The Association supported the view that the remedy for the first was the proportionate allocation of scrap, and there was no doubt this would have already been adopted had the administrative staff been available, but one can understand the reluctance to increase staffs at present. With regard to the latter item, members would have seen the warning issued by the Ministry.

Everybody disliked controls and the Council had urged that every attention must be devoted to increasing supplies—costs would then take care of themselves, but, when scarcity prevailed, particularly when it was said to be a world scarcity, steps had to be taken to route supplies so that a balanced production was obtained. The only alternative was an entirely free market, and it was very doubtful if this was practicable under to-day's conditions.

Prices

The control of scrap prices had been a direct outcome of the scarcity of metals. Some thought the ingot makers had had an unfair advantage, since the price of their products was uncontrolled. However, the members of this Association, or any responsible ingot maker, did not take unfair advantage of this situation. Still, it did offer the adventurer a chance, and a demand arose for the control of brass ingot and billet prices. Although this demand could not be overcome, the Council resisted it at every stage, and it felt that a fair price was obtained for brass ingots. What the Council was most dissatisfied with, and what it was fighting hard to remedy, was the £2-a-ton allowance for cropping billets. Many letters clearly setting out the position had been sent to the Ministry on this subject. The president again explained the matter at an interview recently. There was now reason to believe that once the Council had furnished actual costs, the position would be improved. There was also a demand from the founders for an agreement on prices of gunmetal and other alloys.

The founders were valued customers and he was sure all would agree that the Association was right to be prepared to go a long way to meet them. They had submitted a list of prices which the founders thought high. It was natural that if the Association were to be held to a price agreement, it could not be at cut prices, but, as it transpired at the time of the third meeting with them, there was an easing of the market for gunmetal due to the prohibition of export, and they saw the force of the Association's argument that, with competitive conditions returning, founders stood to gain by not having a price agreement. The Association had made very friendly contacts and it was agreed that the subject should be revived at the request of either side.

Future Supplies

Now, as regard the future, the president felt that the members might probably be called upon to face more difficulties than ever before and, without being a "dismal Jimmy," it did seem that supplies of material, notably zinc and brass, would be very scarce. He was opposed to control, but he was inclined to think that without it, under present conditions, prices might have soared beyond all reason. He could not help but compare the present situation with that appertaining during the war, when prices were controlled but, when, owing to restrictions on use, metal was plentiful and prices were below the controlled figure. Then, also, there was "lend-lease," but now the country must find dollars. One could not deny the impression that many of the difficulties were traceable to restrictions, including the 40-hour week. If working time was cut by one-sixth, then surely one should cut the labour force by a like amount. It was useless to say that as much can be produced in 40 hours as in 48 hours. The speed of a motor lorry was restricted by law, yet it was expected to do more miles in less time. It was like asking metal to be kind enough to melt itself in one-sixth less time.

Here the president paid a tribute to the trade Press. It was said that there was a shortage of paper, but there was always room in the large "dailies" (in this time of great crisis) for full reports on the doings of ravishing film stars and other spicey items. He suggested that they should have less, not more, paper and that the quota to the technical Press should be increased. This technical Press, he insisted, was the best in the world. He had had ample proof of this recently in letters received from all over the world.

TECHNICAL COMMITTEE REPORT

British Standards Institution

Mr. W. G. Mochrie, as head of the Association's Technical Committee, reported as follows:—

Aluminium Content in Gunmetals.—This matter was again raised and, after a lengthy discussion in committee it was agreed that no upper limit should yet be set in the aluminium content.

Aluminium-bronze Castings.—One important result from efforts to obtain uniformity in the various specifications from governing bodies is that the Admiralty and the British Standards Institution have compromised in aluminium bronzes, and the result was included in a recent draft from the B.S.I. to industry for comment. There will be another Committee meeting to discuss industry's reactions on this draft, and it is hoped that an amendment slip will be issued for inclusion with the B.S. 1400 series.

Replacement of Service Specifications by British Standards.—Earlier efforts seem to be bearing fruit at last in tidying up all the various types of specifications in current use. As in the case of the Admiralty with the aluminium-bronze, the B.S.I. Air Board and A.I.D. are working together with a view to eliminating as many of the anomalies as possible. It is interesting to note that 2B8 now shows zinc content maximum as 0.05 per cent. instead of the previous "nil." It is hoped to bring

Ingot Makers' Association Report

the scrapping of these Air Board specifications under the ægis of B.S. 1400. Various suggestions have been made to incorporate other alloys under B.S. 1400, each of which has been rejected as their usage was too small.

Leaded Gunmetals in Valves.—Strong criticisms have been received from industry concerning the inclusion of a leaded gunmetal for steam service as suggested in the draft specification circulated early last year. This matter is being put right and he felt that it is of more than passing interest to members of the Association to note accordingly.

Institute of British Foundrymen

A representative has been co-opted from the Technical Council for T.S.38 (concerned with the conservation of non-ferrous metals in the foundry). Among other things, they are extremely interested in the tidying-up of specifications generally and reducing the numbers as far as possible. In this they are giving every support to the N.F.E./14 Committee of the B.S.I.

Levy on Non-ferrous Metals for Casting Purposes

So far the work of the Technical Committee has been of a technical nature and the extent of the practical work has been limited to the facilities of the individual members of the Committee. It is felt that this work could be greatly enlarged, not only for matters concerning the Ingot Association, but also to give greater benefit to the foundries, if the scheme of a levy, suggested by the Technical Committee to the Council through the president, could be adopted. However, that is a matter for the decision of the executive, and it is not proposed to say any more on that subject at this juncture.

Obituary

FORMERLY managing director of the Railway & General Engineering Company, Limited, Nottingham, MR. DICKSON BURNIE died recently. He was 81.

MR. EDWIN WILSON, assistant works manager of Peter Brotherhood, Limited, engineers, of Peterborough, until his retirement last year, has died at the age of 65.

THE DEATH took place on February 3 of MR. GORDON H. FIELD, C.B.E., a former director of research at the Northern Aluminium Company's research laboratories at Banbury.

A DIRECTOR of Negretti & Zambra, Limited, scientific instrument makers, of London, W.1, from 1909 to 1935, MR. MARCUS WILLIAM ZAMBRA, a grandson of one of the joint founders of the company, has died at the age of 74.

MR. WILLIAM TURFORD, formerly a blast-furnace man employed by the Cargo Fleet Iron Company, Limited, and a prominent union official, has died in his 84th year. He was a member of the Middlesbrough Town Council for 35 years and Mayor of the borough in 1938.

MR. JAMES STANLEY BURLEY, who died recently at Solihull, Birmingham, was a director of James Burley & Company, Limited, scrap metal merchants, of Birmingham, from 1917 to 1930. At the outbreak of war he rejoined the company and finally retired in 1945.

MR. GEORGE BARR, former general manager and director of Alley & McLellan, Limited, engineers, of Polmadie, Glasgow, died on February 15 at his home. He joined the firm as a young man and remained with it all his working life, retiring about 20 years ago. He held various administrative positions and travelled extensively.

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained.

ACCRINGTON, March 1—Castings, for the Borough Council. Mr. G. Heys, deputy borough engineer and surveyor, Town Hall, Accrington.

CANNOCK, February 25—Castings, for the Urban District Council. Mr. E. Lomax, engineer and surveyor, Council House, The Green, Cannock.

DERBY, February 28—Drainage sundries and traffic signs, for the County Council. Mr. S. Mehew, county surveyor, County Offices, St. Mary's Gate, Derby.

ELLESMERE PORT, March 3—Cast-iron manhole covers, frames, gully gratings, frames, etc., for the Urban District Council. The Engineer and Surveyor, Council Offices, Ellesmere Port.

GLOUCESTER, March 5—Castings, for the City Council. The City Engineer and Surveyor, 21, Eastgate Street, Gloucester.

HALTEMPRICE, February 21—Cast-iron goods, for the Urban District Council. The Engineer and Surveyor, Anlaby House, Anlaby.

HEBBURN, March 5—Manhole covers, gullies, etc., for the Urban District Council. Mr. T. M. Wright, clerk of the council, Council Offices, Argyle Street, Hebburn.

KEARSLEY, February 29—Cast-iron manhole covers and frames, and street gullies, for the Urban District Council. Mr. E. C. Kirk, engineer and surveyor, Town Hall, Kearsley, Farnworth.

KIDSGROVE, February 28—Iron castings, for the Urban District Council. Mr. J. L. Bleazard, engineer and surveyor, Town Hall, Kidsgrove.

LLWCHWR, March 3—Castings, for the Urban District Council. Mr. F. T. James, Council Offices, Gorseinon.

MORLEY, March 8—Sewerage ironwork, for the Borough Council. The Borough Engineer's Office, Town Hall, Morley.

NEWTON-LE-WILLOWS, March 7—Iron castings, for the Urban District Council. The Engineer and Surveyor, Market Chambers, Newton-le-Willows.

PORT TALBOT, March 1—Pipes, valves, and castings, for the Town Council. The Borough Engineer's Department, Municipal Buildings, Port Talbot.

STOCKPORT, February 23—Iron castings, for the Borough Council. Mr. W. F. Gardner, borough surveyor, Town Hall, Stockport.

SWANSEA, February 20—Concrete-lined and unlined spun-iron pipes and cast-iron specials, waterworks appliances, water meters, etc., for the Town Council. The Borough Water Engineer and Manager, The Guildhall, Swansea.

TYLDESLEY, February 23—Cast-iron manhole covers and frames, and gully gratings and frames, for the Urban District Council. The Engineer and Surveyor, Town Hall, Tyldesley.

WASHINGTON, March 3—Cast-iron goods, for the Urban District Council. The Surveyor, Council Chambers, Washington.

Soil and Waste Pipes Above Ground

The Council for Codes of Practice for Buildings has now issued for comment Code 304, "Soil and Waste Pipes Above Ground," together with three sub-codes, all of which have been prepared for the council by a committee convened by the Institution of Municipal Engineers.

They deal with the design and installation of soil, waste, and ventilating pipes where they occur above ground, both inside and outside a building. Rain-water pipes are excluded. The code describes in some detail the system which may be used, and makes recommendations on the layout of pipework and appliances, on suitable fixings for various types of pipe, on traps and ventilating pipes, and on pipe sizes.

The code is in draft form and is subject to amendment in the light of comments, which should be submitted by March 12. Copies may be obtained from the British Standards Institution, 24/28, Victoria Street, London, S.W.1 (5s., post free).

A FIRE at the premises of William Horsfall & Sons, Square Road Foundry, Halifax, on February 9, destroyed some wooden patterns and a quantity of floorboarding. Arrangements have been made to carry on as usual.

Capital Issues

Present Position and New Directions

By F. J. Tebbutt

By the Borrowing (Control and Guarantees) Act, 1946, the Treasury (i.e., the Government) is given power to make Orders regulating the borrowing of money, the issue of securities, flotations, company promotions and the like. The body actually administering these matters, however, is the Capital Issues committee (chairman, the Rt. Hon. Lord Kennet, P.C.), which body is however subject to "directions" from the Treasury. Permission is required from the committee before issue of shares, flotations, etc., can be carried out. The chief directions were made in May, 1945 (by the Coalition Government), and although amendments have been made, these remain the chief directions and the main principle of these applies. Broadly, this means that consideration must be given by the committee as to whether the projects proposed are in the national interest. In the 1945 directions, certain "priorities" are laid down applying to particular trades, industries, and goods, which are to take precedence over other trades, although there is equal priority to the trades listed ordinarily. The committee, nevertheless, is enjoined to give especially sympathetic consideration to undertakings producing or selling for export, and to projects for the special "development areas." Other examples (there are over 10 heads) of the "priorities" are projects for the production and exploitation of raw materials and issues for certain productive and constructional purposes (notified by the Treasury). Although the foregoing directions have not been interfered with, the "national interest" requirement has been stressed by subsequent happenings, and so particular notice must be taken by the committee of directions since issued, which constitute a progressive amplification of the original.

The directions of the then Chancellor of the Exchequer, in April, 1951, were issued in view of the changed circumstances resulting from re-armament and other developments, and although any applications were to be considered against the background of the principal directions (as referred to earlier), the new ones called for a strict and critical examination of all proposals. In brief, the projects which were to be favoured were any essential to enable defence programmes to be achieved; any which would alleviate basic deficiencies, particularly of raw materials; any directed towards import saving and particularly to dollar economy; those directed to increasing exports of a continuing nature to desirable markets; or making for marked technical advances, to new products of importance, and to developments making possible substantial reductions in costs.

New Government Directions

The Chancellor of the new Government (the Rt. Hon. R. A. Butler) has now issued new directions, as follow, addressed to the chairman (Lord Kennet), but still to be read in conjunction with the principal directions enumerated previously:—

"I have been considering how far the principles on which the Capital Issues committee operate may need fresh emphasis in the light of the new economic policy which is being developed by the Government.

"It is clear that the committee must scrutinise all applications by reference primarily to the contribution which they can make to the surmounting of our present difficulties. I would ask the committee to accept this test as their basic criterion, and to apply it in a vigorously critical spirit. Clear priority should be given to projects which are essentially and positively related to the rearmament programme; to the stimulation of exports to desirable markets; to the saving of imports, particularly from dollar sources; and to the relief of basic deficiencies especially of raw materials. Other projects which, in the committee's view, can contribute definitely to the general health of the (country's) economy by the technical development of industrial productions, and the more efficient and economical use of resources, should also receive favourable consideration.

"But for the rest, the committee should submit all applications to a very strict and searching scrutiny, with a view to eliminating any project which is not likely to produce positive results commensurate with the demands which it will make on the limited available resources. In particular, they should discourage all applications in respect of projects for the production of inessential goods, especially where these are intended mainly for the home market, and consist largely of metal-using projects.

"I must ask also that the same strict tests should be exercised in the case of applications relating to those borrowings from banks which in accordance with existing practice under the Control of Borrowing Order are referred to the committee. In particular, the committee will wish, in appropriate cases, to consider what stipulations they should make about the period of such borrowing and ultimate arrangements for repayment or for the provision of permanent finance, in conformity with the general credit policy which I have announced to Parliament. Moreover, where applications are made for consent to long-term borrowings to refund bank advances already taken up, the fact that the money has already been borrowed should not weigh with the committee, who should concern themselves mainly with the eligibility of the purposes which have been financed by the advances or will be made possiblle through the refunding operation."

Elderly Employees' Success

Speaking at a one-day conference of the Institute of Personnel Management in Birmingham on February 13, Councillor A. G. B. Owen, chairman and managing director of Rubery Owen, Limited, said that employees aged 71-85 who work in the firm's "Sons of Rest" shop, have gained an average of one stone in weight, earn between £4 17s. and £6 each week, and never use, except for luncheon or to entertain visitors, the rest room which had been provided for them in deference to their age. Deploring that old people are too often set to work as "sweepers-up and labourers trundling barrows," Councillor Owen asserted that there is plenty of skilled work in industry suitable for elderly operatives. His pensioned employees, whose average age is 75, do light drilling and engineering, assemble locks and components and last year the workshop of 11 men made a profit of £260.

Personal

MR. G. E. LAMB read a Paper recently to the Derby Society of Engineers, on "Some Methods of Mechanically Charging Cupolas."

LORD HIVES, chairman and joint managing director of Rolls-Royce, Limited, and MR. C. R. CREIGHTON, chief sales and service engineer, are on their way to America; later they will visit Canada and Australia.

CAPTAIN H. LEIGHTON DAVIES, chairman of the National Scrap Drive, is to attend the annual general meeting of the Midland Scrap Iron, Steel and Metals Association at the Imperial Hotel, Birmingham, on February 28, when plans will be discussed for the Midland drive for scrap metal.

MR. R. D. ROBERTS has recently been appointed director of personnel for the David Brown Companies. Formerly with the Ford organization, Mr. Roberts was personnel manager at the Dagenham plant, where he also acted as assistant to the manager of the Ford labour relations division.

AT THE ANNUAL MEETING of the Manchester and District Ironfounders' Association at the Midland Hotel, Manchester, on February 12, Mr. J. E. Smethurst, managing director of James Smethurst & Son, Limited, engineers and ironfounders, of Foundry Street, Warrington, was elected president.

COLONEL H. B. SANKEY, managing director of Joseph Sankey & Sons, Limited, Bilston, has been appointed president of the Birmingham, Wolverhampton and Stafford district of the Engineering and Allied Employers' Association, in succession to MR. G. H. SAVAGE, a director of the Rover Company, Limited.

THE CHANCELLOR OF THE EXCHEQUER has accepted the resignation of MR. M. J. BABINGTON SMITH from the Capital Issues Committee. Mr. Smith, who is a director of Associated Electrical Industries, Limited, is also on the board of the Bank of England and the Royal Bank of Scotland. His withdrawal from the C.I.C. is necessitated by increased pressure of his other work.

MR. HARRY PETERS has been appointed general works superintendent at the Birmingham Aluminium Casting (1903) Company, Limited, a new executive position now established by the company in a recent reconstruction of senior posts. MR. A. EVANS succeeds Mr. Peters as manager of the gravity die department, and MR. RALPH DOWLE takes over the management of the aluminium sand department in succession to the late Mr. J. H. Raby. In charge of the toolroom, in addition to his other responsibilities as chief designer, die drawing office, will be MR. HOWARD FAIRBAIRN.

Hepworth & Grandage Expansion

The Bradford engineering and foundry firm of Hepworth & Grandage, Limited, have taken over the Arrow Aircraft factory at Yeadon, near Leeds. This new branch of the firm, which will be known as Hepworth & Grandage (Yeadon), Limited, is to produce jet-aircraft components for the defence programme, and will provide employment for several hundreds when the factory is in full production. More plant is being provided, and skilled workers, such as tool-room operators, are required. The greatest need, however, is for semi-skilled men for training.

Institution of Metallurgists Examination

The next examinations for the licentiateship and associateship of the Institution of Metallurgists will be held from August 25 to September 2. Candidates must submit their applications for permission to enter the examinations before May 1 (overseas, April 1). Each application must be made on a form to be obtained from the registrar-secretary, Institution of Metallurgists, 4, Grosvenor Gardens, London, S.W.1, and must be accompanied by a registration fee of one guinea. The balance of the examination fee will be payable before August 1 (overseas, June 1).

Examinations for fellowships will also be held and intending candidates should apply for permission to enter for the examination, submitting, for the approval of the Council, a statement of the subject of the dissertation or the branch of metallurgy in which they offer themselves for examination.

The Papers set at the examinations held in 1947, 1948, 1949, 1950, and 1951 are available at 1s. per set.

Hand Trapped by Castings

The Staveley Iron & Chemical Company, Limited, were at Chesterfield County Court, recently, ordered to pay £125, including £68 loss of wages, to an employee, John Cooling, of Langwith, under Common Law claim, for damages for a badly trapped hand while stacking hot metal castings.

Appearing for the company, Mr. A. Bate called Mr. J. S. MacGlade, foreman, who said that there were four or five cold castings left from the previous day. There were always gloves for the men to wear and, had Cooling asked for special gloves for his left hand, he could have had them.

"Anyone who thought about it at all and saw castings being piled up on a floor knows well that if you put them down in a confined space, sooner or later one of the castings will topple over if you are not careful," said Judge R. A. Willes in his summing up.

Zinc Alloy Die Casters' Association

At the annual general meeting of the Zinc Alloy Die Casters' Association, held in Birmingham, a report on the year's work stressed the satisfactory increase in membership during the year, the improvement in the availability of supplies of zinc alloy for die-casting, the work done by Z.A.D.C.A. representatives on various Government and other committees, to the teams which had been sent abroad to collect information on die-casting techniques there, and to the liaison established with similar bodies in the U.S.A. and on the Continent. The work of the Association's technical and publications committees was reported on by members of the Z.D.A. staff and covered a large variety of topics from die lubricants to advertising.

Allocations of Oils and Fats.—The Minister of Food announces that allocations of oils and fats to trade users will be reduced from the eight-week period beginning on February 24, 1952. This reduction was foreshadowed by the Minister in the House of Commons on November 29, 1951, when he said that the import cuts in oils and fats would involve very heavy cuts in trade allocations and that only by this means could the domestic ration of margarine and cooking fat be maintained. Details of the revised allocations have been sent to the trade associations concerned.

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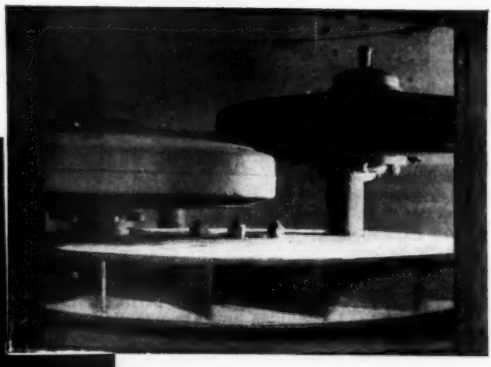

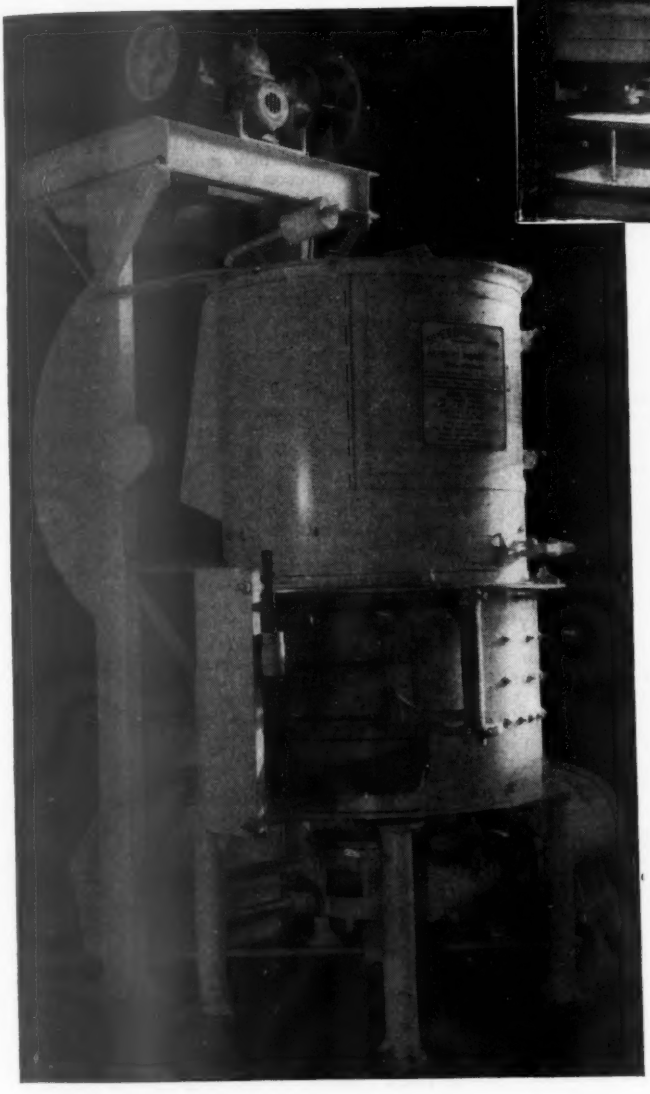

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News in Brief

ARISTON ALLOYS, LIMITED, are planning to extend their foundry at Mill Lane, Croydon, Surrey.

THE RT. HON. LORD STRABOLGI has accepted the chairmanship of L. Bier & Son (Iron & Steel), Limited.

A MINOR EXPLOSION occurred in an annexe to the main buildings at the Erewash Foundry Laboratories belonging to the Stanton Ironworks. Two chemists were injured.

BAKELITE, LIMITED, announce that their northern sales office has now moved to more spacious quarters at the Royal Exchange, Manchester, 2 (telephone: Blackfriars 5174-7).

C. W. TAYLOR & COMPANY, LIMITED, Templetown Foundry, South Shields, are seeking permission to erect additional works buildings and are negotiating for the purchase of a suitable site.

THE LONDON OFFICE of the Nordberg Manufacturing Company, makers of crushing and grinding machinery, is being moved during February from Brook House, Park Lane, to 19, Curzon Street, London, W.1.

THE BUTTERLEY COMPANY, LIMITED, of Ripley, Derbyshire, have secured a contract from the Tasmanian Railways valued at £100,000. The company are to make 140 underframes, each 36 ft. long, for railway wagons.

SETTING UP DEPOTS at district railway stations, farmers in the Kidderminster area organized a scrap metal drive and collected 64 tons of metal, a gratifying result which confirms the general feeling that much useful metal scrap is lying about on farm lands and premises.

A SPECIAL LINE of pistons for automotive engines will be produced in Australia by the Rolloy Piston Company Pty., Limited, of Port Melbourne under a licence agreement with the Al-Fin Division of the Fairchild Engine and Airplane Corporation, of Long Island, New York.

LITHGOWS, LIMITED, Port Glasgow, are to build an 18,000-ton tanker, which will be propelled by machinery provided by David Rowan & Company, Limited, Glasgow. Same builders received orders for three similar vessels last year under the Anglo-Saxon Petroleum Company's £45,000,000 building programme.

AT A SERIES of foundry lectures at the Technical College, Chesterfield, Dr. R. V. Riley, chief research chemist of the Staveley Iron & Chemical Company, Limited, gave a talk on "Cast Iron Research and Development." The president was Mr. N. R. Rees, general foundry manager of the Staveley Company.

THE MINISTRY OF SUPPLY has been invited to send representatives to a meeting in the Central Hall, Coventry, on February 23, at which 1,000 shop stewards are to discuss the problem of short-time working arising from the steel shortage in local factories. During the past fortnight over 1,000 workers have been declared redundant in Coventry.

THE MINISTRY OF MATERIALS announces that, with the agreement of the Canadian and Australian Governments and producers, 30,000 tons of lead supplied under their current contracts with the Ministry have been resold and will be delivered to the United States during the next four months. Prices will be equivalent to the current price for foreign lead in the United States.

THE Eclipse Foundry (Leicester), Limited, recently gave a dinner in honour of 15 employees who have served the company more than 25 years, and a Quarter Century Club was inaugurated. Each veteran was presented with either a clock or a watch; the first was to Mr. W. A. Saunderson, manager, who has been with the firm 30 years, commencing as a moulder. The other 14 recipients had served an aggregate of 420 years.

RESEARCHES have been made for some years into the properties of chromium and its alloys at the Fulmer Research Institute with a view to determining the suitability for high-temperature service of this metal, ample supplies of which exist within the Commonwealth. Dr. A. H. Sully gave some account of this and other work on the subject at a meeting of the London local section of the Institute of Metals on February 7.

SPEAKING at a luncheon of the Birmingham branch of the Incorporated Sales Managers' Association on February 11, Mr. A. Morley, deputy managing director of W. & T. Avery, Limited, deplored the modern tendency for companies to make their range of products too extensive. In consequence, said Mr. Morley, many lines were actually obsolete and, although the companies were obtaining 95 per cent. of their sales from two-thirds of their production ranges, obstinate sales managers refused to withdraw the remainder.

THE RATES charged by the Road Haulage Executive will go up by 7½ per cent. on February 24. While it was stated by the executive that the increased rates were necessary to meet higher wages and other costs, the Road Haulage Association affirms that on the free enterprise side of the industry, a large body of hauliers have found it necessary to apply for an increase of less than half of that charged by the nationalized section during the last two years, during which rates charged by the executive have gone up by almost 33⅓ per cent.

A NEW SCHEME for the training of sea-going engineers opens up a way to the sea, and the engine room which the Shipping Federation has for long advocated as being in the best interests of the shipping industry. The scheme offers an alternative to the four years' workshop apprenticeship required by the present regulations for the examination of sea-going engineers. Hitherto, the position has been that a sea-going engineer served his time in a shipyard or engineering works, and then went to sea as a junior engineer. Now, for the first time, there is an opportunity for youths to become engineer apprentices in much the same way as entering the Merchant Navy as a navigating apprentice.

THE INSTITUTE OF PERSONNEL MANAGEMENT is organizing an advanced course in personnel management to be held at Ford Hotel, London, from March 17 to April 4. For non-members the cost of the course is 40 guineas plus the hotel bill (£2 2s. a day). Details are available from Management House, Hill Street, London, W.1. THE MINISTRY OF LABOUR AND NATIONAL SERVICE is also organizing a conference on "Human Relations in Industry." This is being held at the Institution of Civil Engineers from March 18 to 20. In this case details can be had by writing to the Director of Public Relations, Ministry of Labour and National Service, 8, St. James' Square, London, S.W.1.

FOUR SENIOR EXECUTIVES of the T.I. Group—Mr. H. G. Kernan, Weldless Steel Tube Company; Mr. A. E. V. Sparrow, Talbot Stead Tube Company; Mr. P. Grove, T.I. Group director; and Mr. J. C. Cooper, T.I. Group Service—were the judges of a "save material" competition at the Aston (Birmingham) factory of Tubes, Limited. Prizes to the value of £400 were offered and 501 ideas were submitted, of which 200 were selected and put on show at an exhibition in the works canteen. The management, which offered the help of carpenters, maintenance men, artists, etc., to employees to interpret their suggestions, is confidently hoping that several valuable suggestions can be incorporated in works practice.

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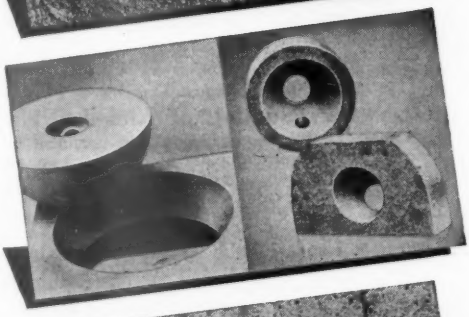

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Raw Material Markets

Iron and Steel

The stringency in supplies of pig-iron continues to hinder the activities of all foundries. The closing down of a furnace in South Wales will result in a further deterioration in supplies of hematite pig-iron for about four or five weeks, and foundries taking supplies from that furnace will find it difficult, if not impossible, to make good the shortage from other sources. No longer is it possible to draw upon stocks either at the furnaces or at the foundries; stocks, if they exist at all, must be lower than they have been for some years.

Apart from hematite, the engineering, speciality, and textile foundries are short of low- and medium-phosphorus iron and refined iron, and there is increasing interest in suitable grades of foreign pig-iron, but these are not available at present. Some foundries would be quite willing to bear the higher cost of imported iron if it could be obtained. Producers of high-phosphorus pig-iron are despatching maximum tonnages to the light and jobbing foundries, but deliveries fall far short of requirements.

Supplies of scrap to the steelworks show no improvement, and steelmakers are in urgent need of larger quantities of pig-iron. These can only be achieved by further encroachment on supplies to the foundries. Expansion of outputs is the only answer, and although fresh units are waiting to be blown in, the supply of coke appears to be inadequate to permit this. Many of the furnaces now in blast find difficulty in obtaining all the coke they require and are further handicapped by the inferior quality and size of some of the consignments supplied to them. Ore supplies are coming forward satisfactorily and, providing these are kept up, pig-iron production could be increased when more coke becomes available.

Deliveries of steel semis to the re-rollers show no improvement and only short-time working is possible. There is little prospect of home steelworks increasing deliveries, and Continental consignments are very small. Re-rollers are hopeful that some steel from the United States and Japan will ultimately reach them. It is not expected that American supplies will be received before the second half of the year, but, as it is understood that a larger proportion of the purchase negotiated with Japan will consist of semi-manufactured steel, it is hoped that some deliveries will be made to them within the next few weeks.

All the re-rollers are working under very difficult conditions as regards both materials and labour, and their operations have to be programmed on a day-to-day basis. Heavy demands continue for all their products. The re-rollers of sheets are inundated with orders, which are heavily in arrears for want of sheet bars.

Non-ferrous Metals

There was a discussion last week between a deputation from the Metal Exchange and Lord Swinton, the Minister responsible for materials. It is understood that officials of the Ministry of Materials are to scrutinize the detailed plans of a possible reopening of a free market in lead with particular reference to the foreign exchange aspects of the problem. This may well prove to be a stumbling-block to the re-establishment of a completely free market, but it is believed that the Metal Exchange interests feel that loss of dollars under a condition of free enterprise in lead is not likely.

This announcement of the talks about a free market puts an end to the rumours that have been circulating in regard to a possible reopening in lead, but metal people were, nevertheless, considerably surprised to learn last Friday, of the sale through the Ministry of Materials, of some 30,000 tons of lead to the United States. This metal is to be delivered ex Canada and Australia, from contracts held with the producers by the Ministry, and it is apparently thought that we can well spare this tonnage.

Stocks of lead in this country are certainly large at present. The sale price is reported to be about 19 cents per lb., which is the quotation current in America. This is equal to £152 per ton and is, therefore, nearly £20 below the U.K. price level. On the Continent buyers are to-day paying about £160 or less, so that lead users in this country are worse off than anyone else.

Figures have been published by the British Bureau of Non-ferrous Metal Statistics relating to the month of December. These show that stocks of virgin copper at December 31 were down by about 6,000 tons, to 113,359 tons Consumption for the month was 43,936 tons, compared with 50,295 tons in November. For the 12 months to December 31 last U.K. consumption was 554,858 tons, compared with 526,889 tons during 1950.

In zinc, usage during December was 24,322 tons including virgin and secondary; this compares with 24,994 tons in November. Stocks of virgin zinc, which at November 30 stood at 31,423 tons, increased to 39,659 tons at the end of December. The change in lead stocks was, however, almost spectacular, for the November figure of 56,656 tons jumped up to 77,167 tons at the end of December. Total consumption, at 22,619 tons, well away by about 6,000 tons from the November figure of 28,674 tons.

London Metal Exchange official tin quotations were as follow:—

Cash—Thursday, £989 to £990; Monday, £981 to £981 10s.; Tuesday, £980 to £980 10s.; Wednesday, £980 to £983 10s.

Three Months—Thursday, £988 to £990; Monday, £980 to £981; Tuesday, £979 to £980; Wednesday, £980 to £982 10s.

The Exchange was closed on Friday, the day of the funeral of King George VI.

Increased Production of Nickel Ore

Dr. John F. Thompson, chairman and president of the International Nickel Company of Canada, Limited, has announced that production of ore from underground in 1951 was 7,780,000 tons, an increase of 2,000,000 tons over that of the previous year. Total ore mined from both underground and surface operations was 11,800,000 tons, compared with 9,849,000 tons in 1950. The company operated at maximum capacity in 1951. Emergency facilities were installed and put into operation several months ahead of schelule, bringing the company's rate of nickel production to 21,000,000 lb. per month, an increase of 5 per cent. over the rate prevailing prior to mid-year. Sales of nickel, nickel alloys, copper, platinum and other products in 1951 are estimated at $286,700,000 (in terms of U.S. currency), compared with $228,071,346 in 1950.

While engaged in maximum production, International Nickel also pushed towards completion its extensive underground development programme initiated during World War II. It was stated that by the end of 1953, when production from surface operations will be fully replaced, the company will be able to hoist 13,000,000 tons of ore a year, which is twice as much from underground as in any year prior to 1951.

ANTIMONY ORE (basis 60 per cent.) is now nominally quoted at 42s. 6d. to 47s. 6d. per unit, c.i.f., against 45s. to 50s. nominal previously.